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A Decade of Learning Management System Research: A Bibliometric Analysis (2014–2023)

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ABSTRACT
This bibliometric analysis aims to explore the trends and developments in the literature concerning Learning Management Systems from 2014 to 2023. The analysis focuses on understanding how Learning Management System research has evolved and identifying key themes and gaps in the existing literature. The study employs a bibliometric approach, utilizing the Dimensions database to collect relevant literature published between 2014 and 2023. Key bibliometric indicators such as the number of publications, citation analysis, and co-authorship networks were analyzed to map the research landscape of the Learning Management System. The analysis reveals a significant increase in publications related to the Learning Management System, highlighting dominant themes such as technological integration, pedagogical effectiveness, and user experience. Key authors, institutions, and countries contributing to this field were identified, showcasing a collaborative network among researchers. The findings indicate a growing interest in Learning Management System research, emphasizing the need for further exploration of pedagogical strategies and technological advancements. This study underscores the importance of addressing existing gaps in the literature to enhance educational practices and outcomes through effective Learning Management System implementation. The Bibliometric Analysis of Learning Management Systems is beneficial to stakeholders in the education and research sectors. The findings of the study can help administrators and educators improve the implementation of pedagogical systems and strategies, as well as develop effective curricula. Researchers can also leverage these results to direct future studies and collaborations, as well as focus on under-researched areas or new trends, contributing to the advancement of knowledge in these areas.

Keywords: *Learning Management Systems; Bibliometric Analysis; Educational Technology; Research Trends; Pedagogical Strategies*

INTRODUCTION

A Learning Management System (LMS) is software designed to assist in managing learning and development activities. It serves as a digital platform that enables educators and trainers to create, organize, and deliver educational content more efficiently. According to Pamungkas (2022), an LMS is defined as a software platform designed to enhance and support teaching in various settings, particularly in online education. Rahmat and Sutojo (2023) further explain that an LMS is articulated as an online framework designed to facilitate the delivery of educational content, assignment submissions, discussion forums, and interactive video presentations. With a focus on user experience, an LMS can significantly improve usability and

learner satisfaction, especially in addressing common challenges faced by students when navigating such systems. Rouf (2019) states that an LMS aims to simplify the educational process and enhance data management within learning settings. Its user-centered approach plays a crucial role in improving usability and learner satisfaction, particularly in helping students overcome typical obstacles encountered while using the system. The primary goal of an LMS is to streamline education processes and optimize data management in educational settings. Prestianta (2021) regards an LMS as an essential framework that facilitates online education. The effective implementation of an LMS is critical to ensuring that all learners have equitable access and support throughout the learning process. Meanwhile, Nugroho and Zuhdi (2017) argue that an LMS can be optimized through the integration of information technology to enhance evaluation processes within educational settings. Their research emphasizes the importance of efficient data organization and management to support teaching and learning activities. In conclusion, an LMS can streamline educational processes and improve assessment validity. This aligns with a broader understanding of an LMS as a vital tool for managing educational resources and facilitating effective learning experiences.

Based on the perspectives above, a Learning Management System (LMS) is software designed to enhance and support teaching processes across various settings, particularly in online education. An LMS serves as a digital platform that enables educators and trainers to create, organize, and deliver educational content more efficiently. It includes features such as assignment submission, discussion forums, and interactive video presentations, thereby improving user experience and learner satisfaction. With a focus on efficient data organization and management, an LMS aims to simplify educational processes, enhance assessment validity, and ensure equitable access and support for all learners. Therefore, an LMS is regarded as a vital tool for managing educational resources and facilitating effective learning experiences.

Research on Learning Management Systems (LMS) is crucial as LMS plays a significant role in improving the quality and effectiveness of educational institutions. By understanding how an LMS works, ways to enhance learning processes and support better educational development can be identified. According to Supangat (2023), an LMS functions not only as a tool for managing resources but also as a framework that supports better decision-making and overall improvement in educational quality. Similarly, Gea (2022) stated that an effective LMS can enhance the operational efficiency of educational institutions, facilitate better decision-making, and improve transparency in data management. Natalia and Prasetyo (2022) further emphasized that an LMS is not only essential for enhancing the quality of education but also for ensuring the sustainability and resilience of educational institutions in facing future challenges. LMS is a vital tool that significantly contributes to improving the quality and effectiveness of education within an institution. It serves not only as a resource management tool but also as a framework that supports better decision-making and enhances data management transparency. An effective LMS can improve operational efficiency, ensure the sustainability and resilience of educational institutions in addressing future challenges, and support overall better educational development.

LMS has become an essential component in modern education that allows for more efficient and effective management of learning. In the wake of the COVID-19 pandemic, many higher education institutions – including theological schools – have begun to adopt LMS as the primary system in distance learning (PJJ). LMS platforms such as Moodle, Google Classroom, Canvas, SEVIMA EdLink, and SPADA Dikti are increasingly being used massively. However, there has been no systematic scientific mapping of the trends, topics, and influences of LMS research in the context of education in Indonesia, especially theological education. Research on LMS increased rapidly between 2014 and 2023, covering aspects of technology implementation, pedagogical effectiveness, and impact on the quality of education. Several

studies show that the implementation of a knowledge management system in educational institutions can improve decision-making and learning quality. This is in line with the findings of Putri (2023) which emphasizes the innovation potential of the use of LMS. Putra et al. (2023) argue that LMS research aims to identify shortcomings in pedagogical approaches, especially related to social criticism in education, so that it is necessary to improve teaching methods that are responsive to social issues. Mustajab et al. (2020) stated that LMS can effectively accommodate a wide range of learners' cognitive abilities, supporting better pedagogical strategies. Erwintha's (2023) research identifies three key factors in LMS implementation: information management, system usage, and educational context, which contribute to the effectiveness of educational delivery. Aldini et al. (2022) emphasize the importance of research and development methodologies, including field studies and direct observations, to improve the relevance and effectiveness of LMS. Although many studies have been conducted, no one has yet used a bibliometric approach to analyze LMS developments and trends, even though this approach is expected to uncover important patterns and identify pedagogical deficiencies.

In the last decade, digital transformation has driven the widespread adoption of LMS in various educational institutions. The use of information technology in education not only increases accessibility but also facilitates more interactive and collaborative learning. Bibliometric analysis is an important tool for understanding the development of research in the field of LMS. This method allows researchers to identify publication trends, author collaborations, and the most researched topics during a certain period.

Bibliometrics is an essential tool in research on LMS. By using techniques such as citation analysis and bibliographic synthesis, researchers can objectively evaluate and map the intellectual landscape of this field. This helps improve the accuracy of literature reviews and reduces bias that might arise in subjective evaluations. This systematic approach is crucial for identifying emerging trends and building a comprehensive understanding of the Learning Management System research field, thus advancing knowledge in the overall development of LMS (Miati et al., 2023). The benefit of bibliometric analysis in LMS research is mapping the research landscape in this domain. With this method, researchers can identify influential works and uncover emerging trends, making this analysis a tool to deepen understanding and guide future research in the Learning Management System domain (Nandiyanto & Al Husaeni, 2021). Furthermore, comprehensive bibliometric analysis highlights the important contributions of dialogic pedagogy to educational practices. This study identifies trends in scientific research and emphasizes the importance of reflective and critical pedagogical strategies, which can inform LMS research by recognizing effective teaching methodologies and their impact on learning outcomes. This bibliometric approach not only uncovers the development of research in dialogic pedagogy but also stresses the need to integrate this pedagogical framework into LMS to enhance educational effectiveness (Bayona Arévalo & Bolaño García, 2023). Bibliometric analysis is useful for evaluating the research landscape systematically, and this method can be directly applied to studies on LMS (Dima et al., 2022). Another benefit of this research is conducting bibliometric analysis on LMS, which can reveal trends in scientific output, publication levels, and shifts in research perspectives over time. This analysis helps illustrate the evolution of Learning Management System research and provides insights into the direction of future studies (Sobral, 2020).

Based on the perspectives above, bibliometric analysis is an essential tool in Learning Management System research, enabling researchers to objectively evaluate and map the intellectual landscape of this field. Through techniques such as citation analysis and bibliographic synthesis, this approach helps improve the accuracy of literature reviews and reduces bias in subjective evaluations. Bibliometric analysis maps influential works, uncovers research trends, and helps identify effective pedagogical strategies, such as dialogic pedagogy, which contribute to improving learning outcomes. This systematic approach provides a

comprehensive understanding of the development of LMS research, offers direction for future studies, and supports the development of more effective LMS.

From the explanation above, the research problem can be formulated as: How does bibliometric analysis on Publication Trends, Publications and Citations by Country, Top Authors and Their Contributions, Research Focus, and Implications of LMS during the period 2014 to 2023? The purpose of this research is to analyze and elaborate on the Publication Trends, Publications and Citations by Country, Top Authors and Their Contributions, Research Focus, and Implications based on bibliometric analysis of LMS in the period 2014-2023. The novelty of this research lies in the use of bibliometric methods to identify trends in sermons over the past 10 years. Bibliometric analysis has not yet been used to explore sermon trends within the 2014-2023 period.

METHOD

Research Design

This study was conducted using a bibliometric approach. Bibliometric analysis is a very important tool in research on LMSLMS. This systematic approach is essential to identify emerging trends and build a comprehensive understanding of the research domain, which is essential to advancing knowledge in LMS. This systematic approach is essential to identify emerging trends and build a comprehensive understanding of the research domain, which is essential to advancing knowledge in LMS (Miati et al., 2023).

Data Collection and Analysis

This study employed a bibliometric approach to systematically map research trends and developments in the field of LMS. Bibliometric analysis enables the identification of emerging themes and the comprehensive assessment of scholarly output, which is essential for advancing knowledge in this domain (Miati et al., 2023).

The data for this study were sourced from the Dimensions database, a reputable platform offering extensive coverage of scholarly literature across disciplines. Dimensions was chosen for its comprehensive indexing, robust citation metrics, and advanced filtering capabilities. Inclusion Criteria: 1) Publications containing the keyword "Learning Management System" in the title, abstract, or keywords; 2) Journal articles only, to ensure data quality and peer-reviewed content; 3) Publications released between 2014 and 2023; 4) Publications in all languages and from all countries. Exclusion Criteria: 1) Non-article publications (e.g., books, conference proceedings, reports, patents); 2) Articles published before 2014 or after 2023; 3) Duplicates and incomplete records.

The search was conducted on October 15, 2024, using the keyword "Learning Management System." Initial results yielded 109,021 documents. Filters were then applied to: 1) Restrict the publication period to 2014–2023, resulting in 79,750 documents; 2) Limit the document type to journal articles, resulting in a final dataset of 48,030 articles. A more specific procedure for document selection is shown in Figure 1 below.

Data organization and preliminary analysis were conducted using Microsoft Excel, which facilitated efficient data cleaning, sorting, and extraction of key bibliometric indicators (e.g., titles, authors, publication years). For advanced bibliometric mapping and visualization, VOSviewer was employed due to its user-friendly interface and powerful capabilities in generating co-authorship, co-citation, and keyword co-occurrence networks. VOSviewer is widely recognized in bibliometric research for its effectiveness in visualizing large-scale scientific landscapes.

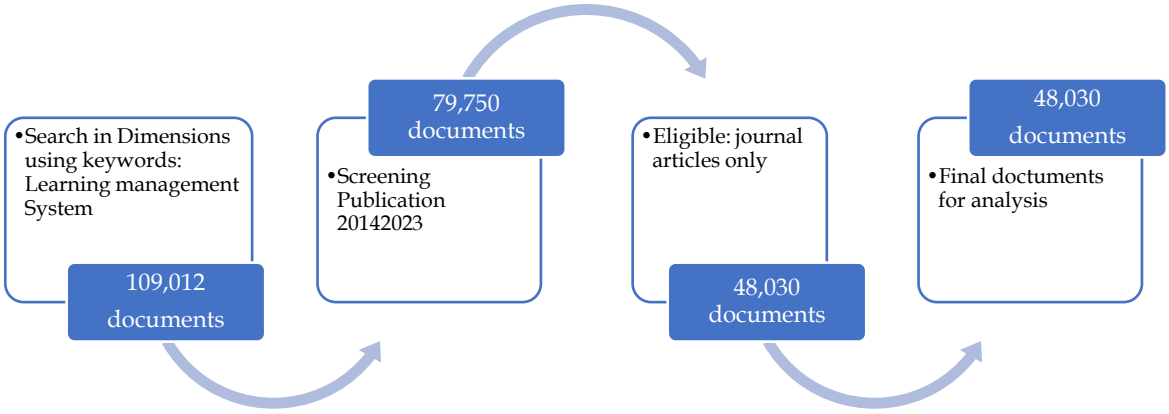

Figure 1. Document Filter Process

RESULTS AND DISCUSSION

Publication Trends

The data in Figure 2 indicates that research on LMS has increased significantly from 2014 to 2023. The use of LMS began to increase slowly in 2018 and continued to grow until it peaked in 2022. This significant increase was likely due to the need for online learning, especially during the pandemic that caused many institutions to switch to online systems. However, in 2023, there was a slight decrease in the use of LMS.

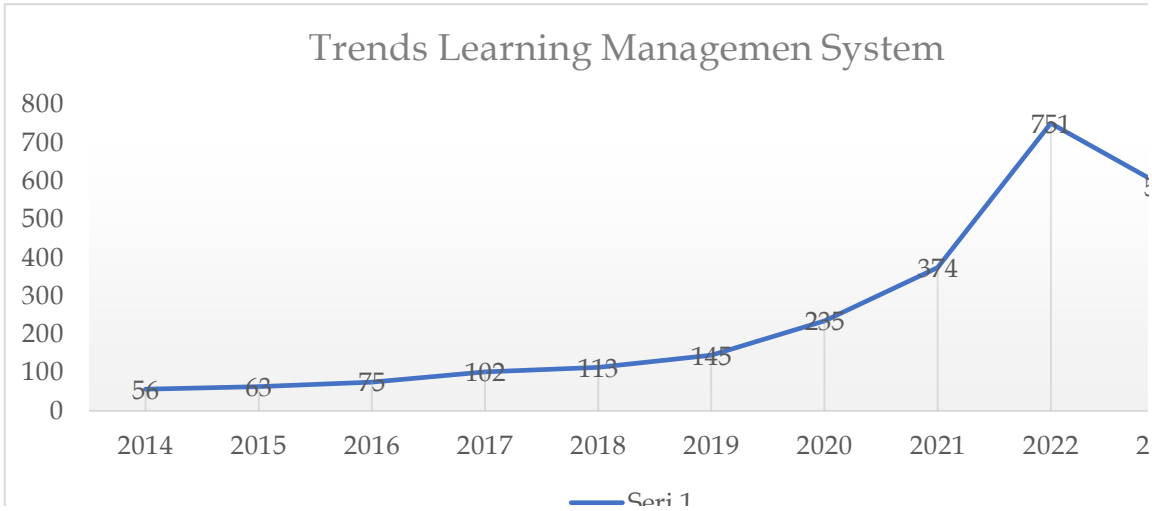

Figure 2. Publication Trends Learning Management System

Referring to the baseline from 2014 to 2015, there was about a 50% increase in 2015-2016 due to the beginning of the phase of accelerating the use of LMS. And then, in 2016-2017, there was an increase of around 30%, as the momentum began to develop. In 2017-2018, the growth was about 25%, as more institutions started adopting LMS. The increase was about 20% in 2018-2019, as the use of LMS became more widespread. Then, in 2019-2020, with the COVID-19 pandemic, there was a drastic increase of about 40%, as all schools and universities had to rely on digital technology to continue the teaching and learning process. There was a stabilization with a 15% increase in 2020-2021, as the global situation started to normalize. The peak occurred in 2021-2022 with an increase of about 35%, due to the continued high demand for remote learning. There was a slight decrease of about 10% in 2022-2023, due to factors such as reduced urgent demand for remote learning or the emergence of more suitable alternative platforms.

The data above denotes that the use of LMS saw significant growth from 2014 to 2022. This increase began to show gradually in 2018, when many institutions started adopting LMS to support remote learning. The peak in the use of LMS occurred in 2022, coinciding with the ongoing need for online learning due to the COVID-19 pandemic. According to a report from Educause (Pelletier et al., 2021), 97% of higher education institutions in the United States reported using LMS as part of their learning strategies.

Several factors have contributed to the increased use of LMS during this period, including: 1) The pandemic forced many institutions to urgently transition to online learning. LMS became the primary solution to address this challenge, enabling teaching and learning to continue despite limited conditions (Gunawan et al., 2024; Salas-Pilco et al., 2022); 2) LMS offer flexibility in terms of time and location, which is crucial for students with other commitments. It also allows access to learning materials from any location (Gunawan et al., 2024); 3) The development of information and communication technology has enhanced the functionality of LMS, including integration with collaboration tools and multimedia, which enriches the learning experience (Keles & Özel, 2016; Ohliati & Abbas, 2019).

In 2023, there was an indication of a decline in the use of LMS. Several reasons may explain this phenomenon, including: 1) With the reduction of pandemic-related restrictions, many institutions have returned to in-person learning methods, thereby decreasing the need for LMS; 2) There are now many new platforms offering features more aligned with user needs, such as mobile applications and more interactive collaboration tools (Halidini Qendraj et al., 2023; Hussein et al., 2023). This could divert users' attention from traditional LMS.

Although there was a decline in the use of LMS in 2023, the overall trend reveals that LMS remain an integral part of modern education. Their ability to support flexible and accessible learning makes them an important tool in the ever-evolving educational landscape. Further research is required to explore how LMS can adapt to future changes in user needs and technology.

Publication and Citation per Country

The researcher then conducts an analysis using VOSViewer and Excel to find publications and citations by country.Based on the results of the analysis using VOSviewer and Excel, it can be viewed that the countries that contributed the most to research on the topic of LMS were the United States and Australia.

Table 1. Publications, Citations and Link Strength Per Country

No	Country	Documents	Citations	Total Link Strength
1.	United States	1097	9384	409
2.	Australia	201	3786	230
3.	Canada	152	2356	113
4.	China	117	2008	146
5.	Saudi Arabia	94	3072	283
6.	India	78	1622	128
7.	United Kingdom	78	1725	86
8.	Germany	74	1301	81
9.	Malaysia	53	995	77
10.	South Africa	46	939	77

Based on the data in Table 1, analyzed using VOSViewer and Excel, it can be seen that there are 10 countries that have made significant contributions to research on LMS over the past 10 years. The two most contributive countries are the United States with 1,097 documents and Australia with 201 documents.

The research data from the United States on LMS consists of 1,097 documents, which have been cited 9,384 times. Meanwhile, research from Australia includes approximately 201 documents, which have been cited 3,786 times. The data indicates that the country with the greatest impact is the United States, with only 245 documents but a citation count of 10,775. This indicates that on average, each document from the United States receives about 55 citations.

Top Authors and Their Contributions

The researcher then conducted an analysis using VOSViewer and Excel to find top authors, links between authors, and their contributions.

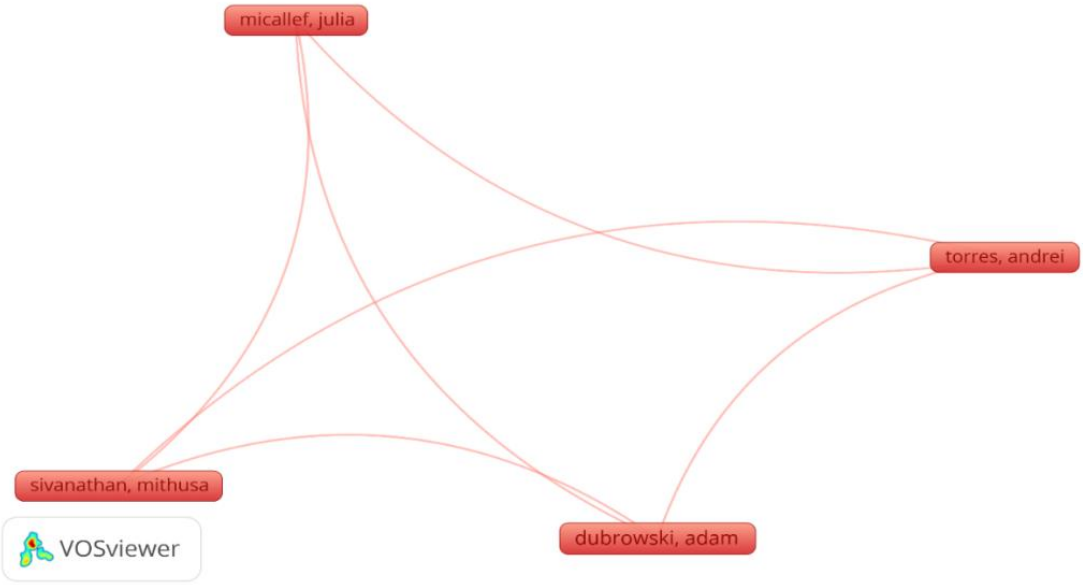

Figure 4. Network visualization map of researcher

Based on the results of the analysis, it is recognized that several studies that contribute the most and have an impact and are interrelated with each other. The data in table 2 reveals the total link strength at 53, 40, and 37. These numbers indicate the relationship or relationship between researchers.

Table 2. Publications, Citations and Link Strength Per Author

No	Author	Documents	Citations	Total link strength
1.	Adam Dubrowski	13	58	53
2.	Chaya Gopalan	7	68	4
3.	María Consuelo Sáizmanzanares	7	199	1
4.	Andrei Torres	7	33	37
5.	Brent Thoma	6	85	5
6.	Edward D. Verrier	6	166	0
7.	Anant Bhan	5	85	0
8.	Patricia A Halpin	5	24	4
9.	Julia Micallef	5	32	40
10.	Mohammed Saqr	5	311	1
11.	Mithusa Sivanathan	5	32	40
12.	Joni Tornwall	5	12	0
13.	Yusuf Yilmaz	5	60	5

Based on the data in Table 2, Adam Dubrowski is the most productive author with 13 publications, showing a significant contribution to the LMS literature. Authors such as Chaya Gopalan, María Consuelo Sáizmanzanares, and Andrei Torres follow with 7 publications respectively. Mohammed Saqr stands out with a high citation count of 311, despite having only 5 publications, indicating that his work is highly regarded and influential in the field. Other authors, such as Edward D. Verrier and Brent Thoma, also have significant citation counts relative to their number of publications, indicating impactful research.

The total link strength metric indicates the connections among researchers. For example, Adam Dubrowski has a link strength of 53, indicating strong collaborative ties or thematic connections with other researchers in the LMS field (Table 2 and Figure 4). The analysis results indicate that the Learning Management System field has seen significant scholarly activity from 2014 to 2023, with various authors contributing to its development. Citation metrics highlight that while some authors have produced many publications, others have achieved high impact with fewer works. This reflects the ongoing interest and relevance in Learning Management System research, emphasizing its importance in educational technology discussions.

Research Focus

To find out the research trend, the author conducted a research focus analysis. The results of the VOSViewer analysis are shown in Figure 5.

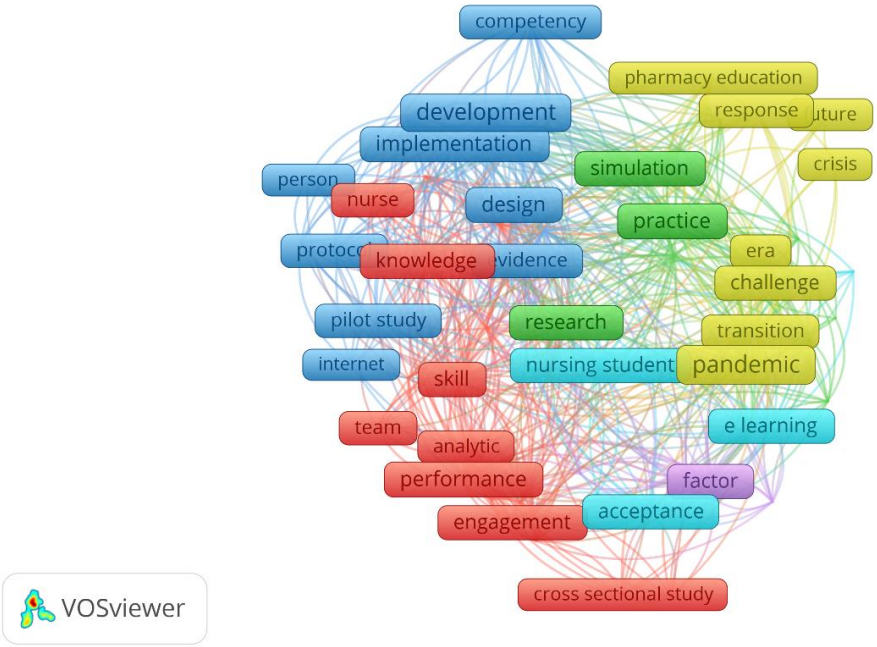

Figure 5. Network visualization map of keywords

Based on the clusters above, it can be understood that each cluster has its own focus of discussion.

The popular keywords in Cluster 1 (Red) are Academic performance, Analytic, Attitude, Confidence, Cross-sectional study, Distance learning, Engagement, Influence, Knowledge, Module, Nurse, Performance, Pharmacy student, Problem, Relationship, Review, Role, Self, Skill, and Team. Cluster 1 emphasizes students' academic performance, particularly in the context of professional education such as nursing or pharmacy. Topics like skill and knowledge development are crucial in enhancing student engagement and academic performance. Research reveals that active student engagement in learning contributes to better academic outcomes, especially in demanding fields like nursing and pharmacy (Roberts & Rizzolo, 2023).

Additionally, studies indicate that student attitudes and confidence also play a significant role in influencing their academic performance (Pruitt et al., 2017).

The popular keywords in Cluster 2 (Green) are Adoption, Covid-19, Creation, Health professions education, Implication, Integration, Nursing, Online teaching, Practice, Research, Simulation, Student engagement, Systematic review, and Time. Cluster 2 focuses on health professions education during the COVID-19 pandemic. Research in this cluster highlights the adoption of online simulation, online teaching, and how medical practices were learned and taught during the pandemic, with a particular focus on student engagement in learning. The studies in this cluster reveal that many health education institutions had to quickly adapt to integrate online learning and online simulations into their curricula (Chipamaunga et al., 2023; Hays et al., 2020). Student engagement in online learning became a primary focus, with research indicating that the student learning experience could be influenced by the teaching methods employed during the transition to online education (Patricia Aguilera-Hermida, 2020).

The popular keywords in Cluster 3 (Blue) are Competency, Design, Development, Evaluation, Evidence, Implementation, Internet, Outcome, Person, Pilot study, Program, Protocol, and Randomized controlled trial. Cluster 3 is more focused on the development of educational programs, particularly on how student competencies are evaluated through the designed and implemented programs. Research methods such as pilot studies are often used to assess the effectiveness of educational programs in achieving the desired outcomes (Naeem & Khan, 2019; Olsen et al., 2022). Studies reveal that well-designed and systematically evaluated programs can improve student competency and prepare them for professional practice in the healthcare field (Chipamaunga et al., 2021).

The popular keywords in Cluster 4 (Yellow) are Challenge, Crisis, Era, Future, Innovation, Pandemic, Pharmacy education, Response, and Transition. This highlights the challenges faced by the education sector during the pandemic. Topics such as crisis challenges and responses relate to how educational institutions, particularly in pharmacy education, adapted to the crisis conditions and changes brought about by the pandemic. The transition to online learning was not only a logistical challenge but also a profound shift in pedagogical approaches. For example, a study by Mpungose (2020) emphasizes the vulnerabilities of traditional face-to-face learning environments and the urgent need for institutions to adapt to e-learning modalities to ensure the continuity of education during the pandemic. Additionally, Cahapay (2021) discusses how education serves as a driver of aspiration even amidst crises, reinforcing the idea that educational institutions must evolve to meet students' needs during difficult times.

The popular keywords in Cluster 5 (Purple) are Covid-19 pandemic, Factor, Intention, Quality, Social medium, Student satisfaction, and University student. In Cluster 5 (Purple), the focus shifts to the factors influencing student satisfaction during the COVID-19 pandemic, particularly in relation to the use of social media and the quality of online learning. Research by Almaiah et al. (2020) identifies the challenges and critical factors affecting the use of e-learning systems, highlighting the importance of understanding student needs to enhance satisfaction and engagement in online education. Furthermore, Mishra et al. (2020) explore the essence of online teaching and learning, providing insights into how educational institutions can effectively transition traditional learning into online formats, addressing student satisfaction and engagement during the pandemic.

The popular keywords in Cluster 6 (Light Blue) are Acceptance, E-learning, Moodle, Nursing student, and Qualitative study. Cluster 6 centers on the acceptance of e-learning technology among nursing students, particularly the use of platforms like Moodle. A study by Buthelezi and van Wyk (2020) illustrates how the COVID-19 pandemic accelerated the adoption of online LMS in nursing education, emphasizing the need for students to develop metacognitive skills for effective learning in a digital environment. Additionally, a qualitative study by Harerimana and Mtshali (2021) discusses the rapid shift to e-learning in nursing education, highlighting the

importance of innovative teaching strategies to meet students' evolving needs during the pandemic. This transition reflects a broader trend in higher education where institutions were forced to embrace technology to facilitate learning and ensure educational outcomes.

Based on the discussion of the cluster above, it reveals that research related to LMS and education during the COVID-19 pandemic is highly diverse, covering various aspects such as competence development, program evaluation, crisis challenges, and e-learning adoption. Many studies focus on health profession education, such as nursing and pharmacy, with an emphasis on online simulations and student engagement during the crisis. Through research on LMS, this will be an important area of focus, especially in the context of online learning and the use of social media.

Discussion of key findings

The study reveals that the use of LMS has increased significantly from 2014 to 2022, with a peak in 2022 due to the urgent need for online learning during the COVID-19 pandemic. The data presents that after 2022, there is a slight decline in the use of LMS, which may be due to the return to face-to-face learning methods and the emergence of alternative platforms that better suit user needs.

These findings align with previous research that indicates the COVID-19 pandemic significantly accelerated the adoption of educational technology. According to an Educause report, 97% of higher education institutions in the United States reported using LMS as part of their teaching strategy (Pelletier et al., 2021). The correlation between the increased use of LMS and the need for flexibility in learning is also evident in other studies, which highlight the importance of LMS in supporting remote learning (Fauzi et al., 2023; Samson & Yango, 2023; Turnbull et al., 2022). In the context of the COVID-19 pandemic, many studies indicate that educational institutions had to quickly adapt to online learning methods and virtual simulations (Chipamaunga et al., 2023; Hays et al., 2020). This is consistent with the finding that students' learning experiences were influenced by the teaching methods during the transition to online education (Patricia Aguilera-Hermida, 2020). The challenges faced during the pandemic also created an urgent need for educational institutions to innovate their pedagogical approaches (Cahapay, 2021; Mpungose, 2020).

However, the decline in usage in 2023 indicates that educational institutions began returning to traditional methods, reflecting the dynamics of technological adaptation in education that has been discussed by various researchers. The adoption of e-learning technology, particularly platforms like Moodle, demonstrates how the pandemic accelerated the digital transformation in education (Buthelezi & Van Wyk, 2020). This reflects a broader trend in which educational institutions must embrace technology to ensure the continuity and quality of education.

Theoretical Implications

The bibliometric research findings on LMS from 2014 to 2023 offer several significant theoretical implications for learning management, educational technology, and quality management.

Implications for Learning Management

In the context of learning management, the bibliometric analysis of LMS from 2014 to 2023 indicates that the effective implementation of LMS can significantly enhance the quality of teaching. LMS serve not only as tools for managing educational resources but also for increasing interactivity in the teaching and learning process. Research reevals that interactive features in LMS, such as discussion forums and online quizzes, can boost student engagement and facilitate more active learning (Holmes & Prieto-Rodriguez, 2018; Wihastyanang et al.,

2015). Therefore, learning management should focus on selecting and implementing LMS that support these interactions to achieve better learning outcomes.

The design of LMS should also consider the cognitive needs of students to create a responsive and adaptive learning experience. Research shows that LMS designed with learning design theory in mind can result in more effective learning experiences (Chatwattana & Nilsook, 2017; Meyliana et al., 2019). For example, the integration of content management systems and testing management systems within LMS can help present materials that align with students' understanding levels, thereby improving their learning outcomes (Fauzi et al., 2023). Therefore, it is crucial for education managers to involve educators and students in the LMS design process to meet their specific needs.

Furthermore, LMS also serve as tools for collecting and analyzing learning data. By utilizing the data gathered through LMS, education managers can make better decisions based on accurate and up-to-date information (Ahmed & Mesonovich, 2019; Brady & O'Reilly, 2020). For example, analyzing LMS usage data can provide insights into the effectiveness of teaching methods and assist in better curriculum planning (Ekuase-Anwansedo & Smith, 2019). Therefore, it is important for educational institutions to develop policies that support the use of data from LMS in strategic decision-making (Turnbull et al., 2022).

Implications for Learning Technology

The implications for learning technology from the bibliometric analysis of LMS (LMS) from 2014 to 2023 reveal that integrating information technology into LMS can significantly enhance pedagogical effectiveness and facilitate collaborative learning. Research indicates that using the latest technology in the design of LMS is crucial for supporting better interaction between students and instructors, as well as creating a more dynamic and responsive learning environment (Ahmed & Mesonovich, 2019; Bradley, 2020). By adopting the right technology, LMS can provide a platform that enables more effective collaboration, which in turn can increase student engagement in the learning process (Samson & Yango, 2023; Tolmachev et al., 2022).

The bibliometric analysis results also highlight the necessity of innovation in the design of LMS (LMS) to meet the demands of modern education. Developing new features that enhance student engagement and facilitate more interactive learning is increasingly important. For instance, LMS platforms equipped with gamification elements or collaborative tools can boost student motivation and enrich their learning experience (Chergui et al., 2020; Tjahjono et al., 2020). Research by M. Ali Hussein & Al-Chalabi (2020) and Haugsbakken et al. (2019) indicates that LMS platforms designed with a focus on pedagogical needs and the latest technologies can create more engaging and effective learning experiences.

With the growing adoption of LMS in various educational institutions, it is crucial to continuously monitor usage trends and assess their effectiveness in diverse educational contexts. This study provides insights into how LMS can be optimized to address the evolving needs of education. For example, analyzing LMS usage data can help identify student learning patterns and pinpoint areas requiring improvement (Bradley, 2020; Spreadborough & Glasser, 2022). Therefore, educational institutions need to develop adaptive and responsive strategies to address changing educational needs and advancements in technology (Adhiambo et al., 2017; Samson & Yango, 2023).

Implications for Learning Quality Management

The implications for quality management in education highlight the critical importance of establishing quality standards for LMS (LMS) to ensure that all educational institutions adopt systems that are both effective and efficient in supporting the teaching and learning process. This research emphasizes that, without clear standards, the quality of education delivered

through LMS platforms can vary significantly between institutions (Allehaibi & Albaqami, 2017; Nathalia et al., 2023). Therefore, it is essential for educational institutions to adopt and implement measurable quality standards that can be regularly assessed and evaluated.

The bibliometric analysis results further underscore the importance of continuous evaluation of the effectiveness of LMS in improving the quality of education. Routine assessments of LMS features and their impact on student learning outcomes are crucial to ensure that the technology being utilized truly addresses educational needs (Ohliati & Abbas, 2019; Praraksa et al., 2015). Through systematic evaluations, institutions can identify areas for improvement and implement necessary changes to enhance students' learning experiences (Karlsson et al., 2020). This aligns with the principles of Total Quality Management (TQM), which emphasize the importance of continuous improvement across all organizational aspects (Supriyanto, 2015).

Moreover, LMS (LMS) can enhance transparency in the management of educational data, which is critical for institutional accountability. With greater transparency, stakeholders—including administrators, educators, and students—can more easily assess institutional performance and implement necessary improvements (Hadi, 2018). Research indicates that transparency in data management not only boosts accountability but also encourages active participation from all stakeholders in the quality improvement process (Lavidas et al., 2022). Therefore, educational institutions need to develop systems that enable easy access to and analysis of relevant data to support evidence-based decision-making.

The implications for quality management from this research highlight the necessity of developing quality standards, continuous evaluation, and transparency in educational data management. By applying these principles, educational institutions can ensure that the LMS they utilize is not only effective in supporting teaching and learning processes but also contributes to the overall enhancement of educational quality.

Practical Implications

The findings of this research offer several practical implications that can be applied in educational contexts. These include: First, the development of LMS (LMS) should prioritize user needs and experiences. Interactive features and an intuitive interface can enhance student engagement and simplify system navigation. Second, LMS platforms should support various content formats, such as videos, discussion forums, and interactive quizzes, to accommodate different learning styles among students. Third, Leveraging the latest technologies in LMS can improve pedagogical effectiveness. For instance, integrating analytical tools to monitor student progress and provide faster feedback can significantly enhance the learning experience. Fourth, providing training for both educators and students on how to use LMS effectively can optimize system utilization and improve learning outcomes. Fifth, LMS should have the capability to collect and analyze learning data in real time. This allows decision-makers to conduct continuous evaluations of the effectiveness of learning programs. Ensuring that evaluation data is accessible to all stakeholders—teachers, students, and parents—can improve accountability and transparency in the learning process. Sixth, adopting various teaching approaches tailored to the educational context and student characteristics can boost engagement and learning outcomes. This includes using dialogical pedagogy to facilitate deeper discussions.

Contributions and Limitations

This study provides a scholarly contribution to the field of education. The longitudinal data analysis, covering a significant period of Learning Management System (LMS) usage, offers valuable insights into trends and emerging patterns. The use of analysis tools such as VOSviewer and Excel also provides a clear visual representation of the contributions made by countries and authors in LMS research. However, the study has certain limitations, including

the potential for bias in data selection, as it focuses solely on specific publications and does not consider external factors that might influence the results, such as local or regional education policies. Readers should take into account the social and technological context when interpreting the findings, particularly given the rapid changes in educational technology and user preferences, which may affect the future relevance of LMS.

CONCLUSION

A bibliometric analysis of research trends on LMS (LMS) from 2014 to 2023 reveals significant and diverse developments in this field. This study aims to explore publication patterns, dominant themes, and contributions from various authors and institutions worldwide. The analysis results indicate consistent growth in the number of publications related to LMS during this period. Prominent research themes include the application of technology in education, the pedagogical effectiveness of LMS, and its impact on educational quality. The study also identifies key authors and leading institutions that have significantly contributed to the literature. The bibliometric analysis highlights that LMS serves not only as a tool for educational management but also as a framework supporting pedagogical innovation. Research findings suggest that LMS can enhance students' learning experiences by providing an interactive and collaborative platform. Moreover, gaps in research indicate the need for more pedagogical approaches that are responsive to current social issues. The conclusion of this analysis underscores the importance of using bibliometric methods to understand the dynamics of LMS research. These findings can serve as a foundation for researchers to further explore the effectiveness of LMS in modern educational contexts and identify areas requiring greater focus in the future development of LMS.

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