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Review Article

Cloud Computing in Education: A Revolution in Learning Management Systems

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Abstract

The transformation in the educational environment with cloud-based learning Management Systems (LMSs) has significantly affected the education world. This systematic review aimed to examine the impact of cloud-based LMSs on pedagogy and learning, including the present status, advantages, challenges, and future possibilities of digital education. In addition, the bibliographic analysis was carried out using Dimension.ai. Cloud-based LMSs such as Moodle, 360Learning, Canvas, and Google Classroom have transformed educational delivery by offering scalable and adaptive solutions that exceed the limitations of conventional education systems. Here, several previous studies have shown that cloud technologies have significantly transformed education by improving access to educational materials, fostering collaboration, and enabling personalized learning. Moreover, the results of the bibliographic analysis showed that the collection of almost 604580 documents highlights a broad spectrum of scholarly interests. The collection shows a dynamic research environment using open scientific approaches.

On the other hand, implementing cloud-based LMSs presents significant challenges, including the need for extensive training for both educators and learners, as well as compatibility with diverse technical infrastructures across various educational settings. The primary themes are cost-effectiveness, scalability, accessibility, and data management, while the foremost problems are security, data privacy, and user adaptation. The findings of this study have revealed the significance of cloud computing in enabling educational institutions to provide students with inclusive, scalable, and adaptive learning environments.

Keywords: cloud computing, learning management systems, education, digital learning, e-learning, scalability, data privacy, accessibility, online education

Introduction

The rapid proliferation of digital technology, the methods of information dissemination, exchange, and consumption in the educational field have been significantly transformed (Bennett et al., 2012). In recent years, a notable technological advancement that can be easily seen is the use of cloud computing in educational settings, particularly via Learning Management Systems (LMSs). Cloud computing, in contrast to dependence on conventional on-site infrastructure, denotes the provision of computing services, including processing, databases, data storage, networking, software, analytics, and intelligence via the internet (Cepeda et al., 2006). Many studies have revealed that this alteration is reshaping the dynamics among educational institutions, educators, and learners about learning resources, presenting both novel possibilities and problems for the whole educational ecosystem (Haleem, 2022).

As compared to the technology-based educational methods, the conventional methods of managing instructional resources via localized, on-site systems were often seen to be limited, more expensive, and not practical (Okai-Ugbaje et al., 2022; Pedro et al., 2018). Educational institutions were bound to incur substantial costs for physical servers, software licenses, and specialized IT personnel to operate their learning platforms, resulting in considerably higher operational expenditures. On the other hand, the advancement of cloud computing enables educational institutions to use scalable, more cost-effective solutions that can provide access to instructional tools, resources, and materials from

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any location with an internet connection (Merdianti et al., 2023). Cloud-based LMSs have been recognized to provide several benefits compared to conventional methods, typically accessible via web browsers; these solutions eliminate the need for certain hardware or software installations (Haidine et al., 2022). It has been stated that with the commencement of LMSs, students and mentors may use the platform from any device, such as PCs, tablets, or mobile phones, at any time and from any location, facilitating learning in any environment. This side-by-side advancement and flexibility align with the increasing fashion of remote learning and online education, particularly in response to the worldwide transition to digital education provoked by the COVID-19 pandemic, all over the world. Cloud computing has also been reported to enhance scalability and cost-efficiency, essential for educational institutions (Slater & Wilbur, 1997). Along with higher education, cloud-based solutions have also been noticed to enable schools to adjust their resources according to demand, facilitating the service of thousands of students without sustaining expensive infrastructure expenditures. Thus, the versatility of cloud-based LMSs has the potential to attract educational institutions, particularly those with financial and geographical limitations, making them an appropriate option (Haidine et al., 2022; Okai-Ugbaje et al., 2022; Pedro et al., 2018).

The transition to cloud computing is significantly influencing instructors' methodologies. Cloud-based LMSs have been shown to facilitate cooperative learning by enabling professors and students to share their resources, engage in simultaneous discussions, and collaborate on group projects. In many cases, facilitating collaboration in online and hybrid learning contexts enhances active learning, peer interaction, and engagement (Leong, 2020). In addition, cloud-based services can be designed to provide customized learning that enables course material to be adjusted according to the specific requirements and progress of the student, based on their needs. Along with this, the other benefits include that these systems can be linked with data analytics tools that can monitor student performance, enabling instructors to detect problematic areas and adjust their techniques accordingly.

However, the cloud computing services provide many benefits for education; still, some problems need consideration (Kaliisa et al., 2019). Among these, privacy and data security are significant issues. Unexceptionally, all educational institutions maintain sensitive student data, including academic records, personal and family information; the storing of this data on cloud servers raises concerns of unauthorized access, breaches, data piracy, and compliance with ethical and legal standards. This has increased apprehensions over the efficacy of security measures and the potential hazards of data loss or leakage in cloud systems (Sharma & Rawat, 2020). In addition, cloud-based learning relies on stable internet access and technical infrastructure, which cannot be realized in areas with little or no internet connectivity, especially in countries like India; hence, this also exacerbates the digital divide (Udobia et al., 2024). Besides this, cloud computing-based education has been reported to have essential modifications in accessing, distributing, and managing available educational resources, requiring extensive training, knowledge, and assistance for all users involved. Numerous cloud-based LMS platforms have evolved, each possessing unique features to address the diverse requirements of educational institutions (Agrawal, 2021; Butarbutar et al., 2025; Clark & Mayer, 2016).

This systematic review work was aimed at analyzing the influence of cloud computing on educational LMS. This research was done to assess the benefits of cloud-based LMS, including its diverse areas like cost-effectiveness, scalability, accessibility, and improved collaboration. Here, the challenges presented by security concerns, cost, accessibility, infrastructural requirements, user adaptability, etc., have also been studied. Additionally, this study has also mentioned the impact of cloud technologies on the evolution of education via the integration of current research and practical applications, with the analytical insights on the impact of digital technology in education for educators, administrators, policymakers, and technologists endeavoring to expand access to and methods of instruction. Along with a systematic review, bibliographic data analysis was also conducted using Dimension.ai, to get a crystal-clear overview of research publications and research outputs in the same area, including publications, patents, databases, grants, clinical trials, and policy papers, etc. (Tiwari & Agrawal, 2024). At last, the present study might point towards the required future research approaches and improve resource allocation across several domains.

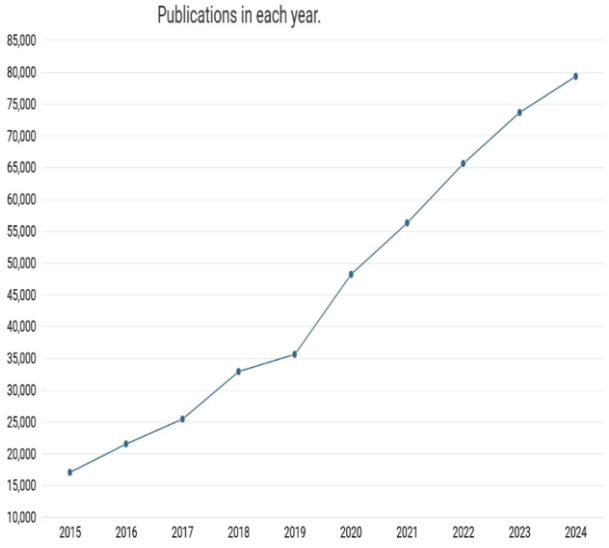
Methodology

A systematic review methodology was used to synthesize current research on cloud computing inside LMSs. Relevant studies were identified via databases such as Google Scholar, PubMed, ERIC, and ScienceDirect. The search was limited to articles from 2015 to 2024 to ensure the relevance of the findings. Studies were selected based on the following inclusion criteria: Peer-reviewed scholarly articles analyzing cloud-based LMS in educational settings; articles related to the investigation of the benefits, challenges, and implementation of cloud computing in the same; and related publications from diverse educational environments e.g., K-12, higher education, corporate training etc., and following the screening process, 40 articles were selected for assessment. In addition to this, the literature search for the bibliographic review was performed using Dimension.ai using a combination of keywords, "cloud computing in education," "learning management systems (LMSs)," and "cloud-based LMS."

Results

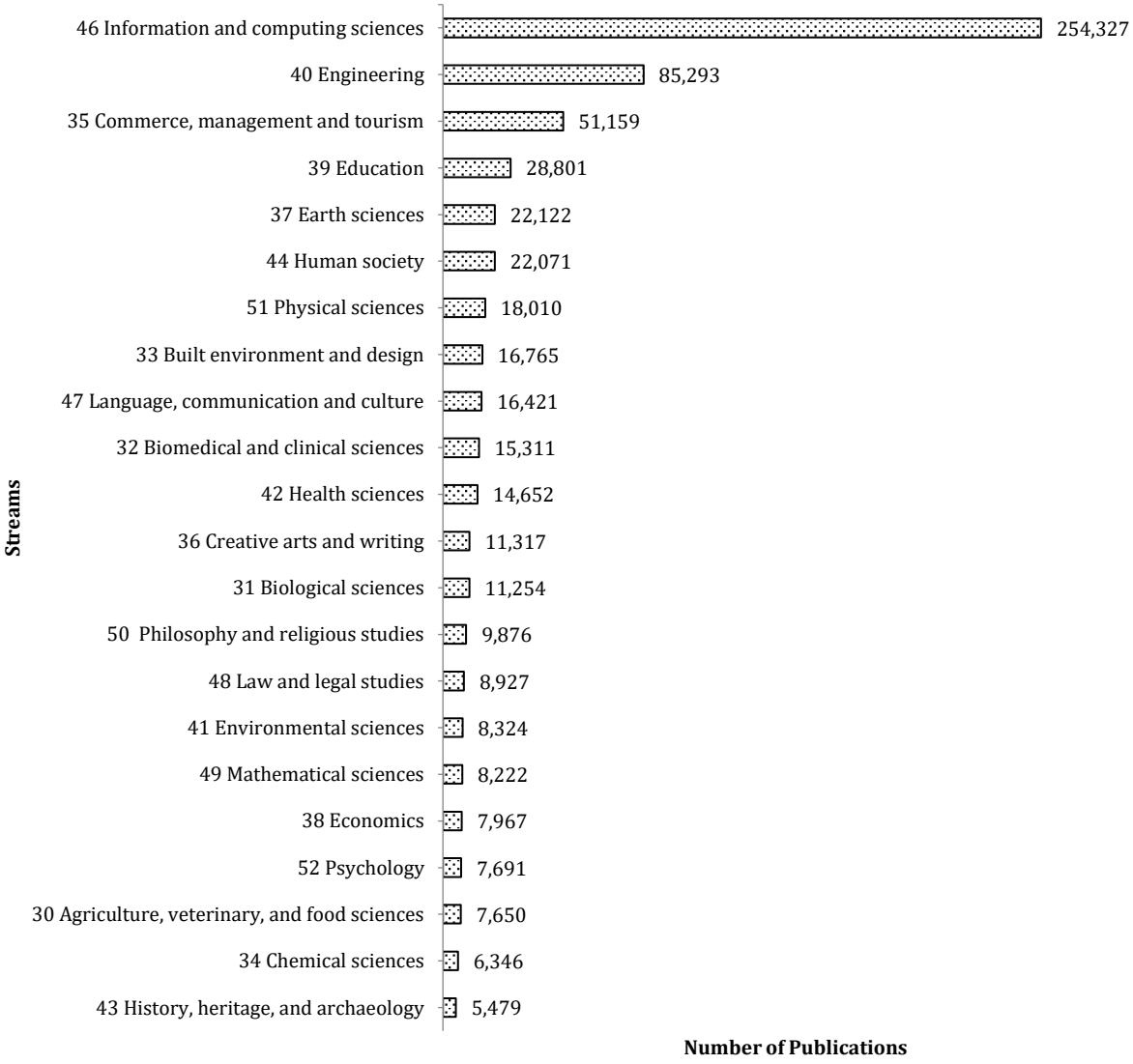
The bibliographic data showed 604,580 papers using the keywords "cloud computing in education," representing a considerable volume of scientific production. Among these, there were 42 datasets of various categories of research outcomes, including a total of 1,299 grants, 119,886 patents documented, and 10,590 policy papers. The number of research paper using the above-mentioned keywords were found to be 257,391 (42%) publications, book chapters constitute around 146,396 (24%) of the total publications, indicating a substantial corpus of work in edited volumes. Proceedings constitute 12.5% (76,060) of total publications. The number of edited books was reported to be 62,401 (10.3%) of the overall output. Preprints constituted around 31,787 (5.3%) of all publications, denoting research scattered prior to peer review. This indicated that several research studies have been going on in this area of education.

Figure 1
The Visualization Shows the Number of Publications Published Each Year (from 2015 to 2024)



Note. From Cloud computing in education, complete data. Retrieved March 9, 2025, from https://app.dimentions.ai. Copyright 2025 Digital Science & Research Solutions Inc

Figure 2
The Visualization Shows the Number of Publications in Different Research Categories



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Benefits of Cloud Computing in Education

A number of studies have revealed that cloud computing has made substantial changes in the implementation and administration of LMS in the educational world. Numerous substantial benefits of cloud-based LMS have emerged, which promote better educational experiences and organizational efficiency. Among many, a key advantage of using a cloud-based LMS is reducing infrastructure costs (Butarbutar et al., 2025; Kaliisa et al., 2019). Traditional LMSs need significant investments in technology, software licenses, data storage, and maintenance, which might be prohibitively expensive, predominantly for organisations with inadequate financial resources. As suggested by many researchers, cloud computing proposes a pay-as-you-go model, significantly reducing the need for initial capital investment and ongoing operational costs (Bremner, 2010; Elen & Depaepe, 2025; Udobia et al., 2024). Other than this, Sharma and Rawat's (2020) research on cloud computing in education indicates that institutions using cloud-based LMS showed substantially decreased IT maintenance and hardware expenditures compared to conventional educational technologies. For example, Google Classroom is a free cloud-based LMS that accommodates institutional scalability, making it an economical option for schools, colleges, and K-12 institutions (Elen & Depaepe, 2025; Morrison & Ross, 2021).

Other than this, cloud-based LMSs can allow educational institutions to adjust their resources. This is particularly highly beneficial to examination periods or the launch of new courses, when the number of users using the system may increase substantially. The ability to dynamically allocate resources is also manageable and can be designed to ensure that cloud services remain efficient and cost-effective (Sitzmann & Ely, 2010). According to research by Qasem et al. (2019), a primary advantage of cloud-based LMS is their intrinsic flexibility, allowing institutions to modify infrastructure rapidly following demand. Moodle Cloud provides different levels of access and storage based on user needs, offering educational institutions a scalable solution that can accommodate rising student enrolments without substantial infrastructure upgrades (Masrat, 2014). This flexibility can also be seen in the use of on-demand services. In addition to this, institutions are also provided with the facilities to choose the necessary level of service, including more storage or sophisticated analytics functionalities, and incur expenses just for their utilization, making cloud computing a versatile and economical option (Butarbutar et al., 2025; Gialamas et al., 2013).

Table 1
The Different Components of Cloud Computing in the Education System

Component	Description	Benefits in education	Examples	References
Cloud storage	Can store data on remote servers that can be accessed via the internet.	Can be accessed from anywhere Collaboration in Real-time Secure data storage and backup is provided	Amazon S3, Google Drive, OneDrive, Dropbox	Almajalid, 2021
Cloud-based LMS	Provide platforms for managing course materials, tracking student progress, and communication.	Streamlined course delivery facility available Help to increase student engagement Can be used for tracking performance	Common are Google Classroom, Moodle, Canvas, Blackboard etc.,	Angelova et al., 2015
SaaS (Software as a service)	Cloud-based software applications for specific/customized services like word processing, email, etc.	It is comparatively cost-effective Provide easy access from different devices Provide diverse collaboration tools and document sharing	Common examples are Adobe Creative Cloud, Microsoft Office 365, Google Workspace,	Bulla et al., 2016
IaaS (Infrastructure as a service)	Provides virtualized computing resources (e.g., virtual machines, storage) over the cloud.	Scalability based on needs Cost savings on infrastructure Supports virtual classrooms and labs	AWS, Google Cloud Platform, Microsoft Azure	Shahzadi et al. 2017
Platform as a service (PaaS)	A cloud platform for building, running, and managing applications without commerce with infrastructure.	Development of custom apps It is mountable and cost-effective for research and teaching Provide collaborative project support	Like Heroku app, Google App Engine, Microsoft Azure App Service etc.	Yasrab, 2018
Various cloud-based communication and collaboration Tools	These provided platforms for online meetings, messaging, video conferencing, and collaborative work.	Also supports remote learning Facilitate real-time communication Group work and collaborative projects	Like Zoom, Microsoft Teams, Google Meet, Slack, Cisco Webex, etc.	Leong, 2015
Cloud-based virtual classrooms, and simulations	Virtual classrooms and simulations for practical, hands-on learning experiences.	Simulations in specialized fields (e.g., engineering, medicine) Can be accessed anytime, anywhere Can be scaled for large classes	Like Labster, Adobe Connect, Virtual Reality (VR) platforms	Jumani et al. 2022
Big data & analytics	Provide tools for collecting, analyzing, and visualizing educational data.	Adoptable for Personalized learning Predictive analytics for student outcomes Institutional improvements through data-driven decisions	Google Analytics, IBM Watson Education	Zeynep and Bilge, 2021
Cloud-based security services	Cloud-delivered security solutions for data protection and compliance.	Protects sensitive data Helps comply with regulations (e.g., FERPA) Secure authentication and authorization	Cloudflare, AWS IAM	Yang and Liu, 2020
Cloud-based AI and machine learning	Enable Cloud-based AI and ML tools for enhancing education with smart solutions.	Provided AI-powered tutoring Automated grading systems Adaptive learning tailored to student progress	Google AI, Microsoft Azure AI, IBM Watson Education	García et al., 2020

Cloud-based LMS can be helpful to improve accessibility by allowing students and educators to engage with educational content, collaborate, and communicate irrespective of local facilities, location, or device. This is especially significant in a world where facilities are limited but online learning, remote education, and hybrid learning settings are prevalent (Butarbutar et al., 2025). As mentioned above, Google Classroom enables students to access different course materials, submit assignments, and engage in conversations from any internet-enabled device. The recent research by Faisal et al. (2017) and Sadiq and Ramzan (2021) has underscored that cloud platforms facilitate enhanced cooperation between students and teachers. Real-time interactions, peer conversations, and collaborative document editing in cloud settings facilitate active learning and dismantle geographical and temporal obstacles without a doubt. Furthermore, along with synchronous learning, cloud computing enables asynchronous learning, allowing students to watch recorded lectures, engage in forum discussions, or examine instructional materials conveniently. This helped improve learning adaptability, especially for adult learners and those in unconventional educational environments (Clark & Mayer, 2016; Merdianti et al., 2023).

Table 2
Prevalence of Cloud-Based LMSs Usage Across Different Educational Sectors

Educational sector studied	Prevalence of use of cloud LMS	Key metrics/ statistics	References
K-12 education	High	80% of U.S. K-12 schools have been reported to use cloud-based LMS platforms	Stein et al., 2013
		Higher secondary teachers 85% of were reported to use cloud-based LMS for lesson planning and collaboration	Qasem et al. 2019
		65% increase in cloud-based LMS adoption was seen after the COVID-2020 pandemic	Outreach, 2017
Higher education	Very high	About 95% of universities worldwide have been known to use cloud LMS platforms for course management	Masrat, 2014
		At the higher education level, 92% of institutions in the U.S. are expected to adopt cloud LMS by 2022	Sadiq and Ramzan, 2021
		Nearly 75% of students prefer cloud-based LMS for online learning	Faisal et al., 2017
Vocational training	Moderate to high	About 55% of vocational education programs have been seen to utilize different cloud-based LMS for skill-based training	Sharma and Rawat, 2020
		Almost 70% of industry-recognized certifications are offered through cloud LMS	Morrison and Ross, 2021
		Growing adoption due to easy learning and online certification requirements	Masrat, 2014
Corporate training	High	About 85% of Fortune 500 companies use cloud LMS for employee training	Sadiq and Ramzan, 2021
		90% of corporate training programs have been shifted to cloud-based platforms since 2019	Sharma and Rawat, 2020
		Almost 70% of companies reported that a significant cost saving was achieved with cloud LMSs	Masrat, 2014

After a number of the above-mentioned advantages, cloud computing also offers a centralized data management solution, facilitating the storage, data backup, and administration of extensive data without reliance on on-premises computers. The chief cloud-based storage systems, such as Amazon Web Services (AWS) and Google Drive (GD), enable educational institutions to securely store and retrieve students' personal data, grades, assignments, multimedia material, etc. A recent research work of Sadiq and Ramzan (2021) has proved the benefits of cloud storage, such as automated backups and real-time synchronization, which helps to protect data against server outages or device problems. In parallel, cloud service providers have often included security mechanisms and sophisticated encryption that protect critical students and learners' personal and educational data. In addition to the discussed facilities, cloud-based solutions have also provided version control, enabling instructors to oversee various repetitions of course materials (as per demand and command of the learner) and implement real-time modifications without the threat of data damage or loss, if maintained properly (Kukulska-Hulme & Shield, 2018).

Challenges of Cloud Computing in Education

However, a number of advantages of cloud-based LMS have been mentioned above, but still, this shift from conventional educational systems to cloud-based LMS has presented some problems. This section focuses on the main obstacles to the extensive use of cloud technology in education. First and foremost, the most important issue with cloud computing in education is data security (Roediger & Butler, 2011). All educational institutions have retained sensitive student data, including their personal information, family data, grades, and assessments, on cloud servers. There may always be a possibility of unauthorized access, hacking, and data breaches that must not be overlooked. In research, Faisal et al. (2017) assert that institutions must precisely evaluate cloud service providers to confirm adherence to security standards, including end-to-end encryption and compliance with legal regulations such as the General Data Protection Regulation (GDPR) and the Family Educational Rights and Privacy Act (FERPA). The thorough analysis of Qasem et al. (2019) has also underscored the significance of transparent data protection rules and robust authentication mechanisms for cloud-based LMS. Notwithstanding these problems, progress in cybersecurity technology, like multifactor authentication, secure sockets layer (SSL) encryption, and cloud firewalls, has made cloud-based applications much more secure. Nevertheless, institutions must maintain watchfulness in mitigating such risks at any level (Bremner, 2010).

The second major issue is that the efficacy of cloud-based LMS is significantly dependent upon internet connectivity. As per the studies, institutions in interior areas, rural locations, or regions with inadequate technology infrastructure have been recognized to face connectivity issues when adopting cloud technologies. Other than this, digital inequality is a substantial obstacle to fair educational access, since not all students own reliable internet connections or modern equipment, as many students do not have proper devices like smartphones, laptops, notepads, etc. A recent study by Sharma and Rawat (2020) has revealed that inadequate internet connectivity in some places hinders students' effective engagement with cloud-based solutions. Similar to this, Qasem et al. (2019) work has also stated that the universities in underdeveloped regions may have difficulties in establishing the necessary technological support and infrastructure to use cloud-based LMS properly.

The one more challenge is that the successful adoption of cloud-based LMS requires that mentors, instructors, and students must get sufficient training to navigate and use cloud-based LMS solutions effectively. Additionally, educational institutions must provide resources for training programs to guarantee that users understand the advantages of cloud technology, especially for content development, vocational learning, skill development, course administration, job-oriented work, and evaluation (Abdul Halim & Luaran, 2024). Research by Sadiq and Ramzan (2021) has underscored that adequate training and assistance are a must to get better outputs and to enable both teachers and students to use the capabilities of cloud-based LMS fully. In a study, Morrison and Ross (2021) have stressed that many educators have challenges in adjusting to new systems, particularly those familiar with conventional teaching approaches, but not technologically sound. Some other, more personalized issues have also been recognized with the use of LMS in education. This is an area of research and deep studies are required to identify correctly and to find a proper solution to the same. However, to mitigate the above-mentioned issues, several cloud-based LMS solutions, including comprehensive documentation, tutorials, and customer assistance, etc. have been under consideration. Nonetheless, consumer reluctance and technical fear continue to pose substantial obstacles to effortless acceptance (Bremner, 2010; Butarbutar et al., 2025; Slater & Wilbur, 1997).

The Role of Cloud-Based LMS in Personalized Learning

Cloud-based LMSs have been known to enable the provision of personalized education. This teaching methodology customizes material and evaluations to the unique requirements, preferences, and learning speed of each student. In addition, the same can save a lot of time, energy, and expenditure for the learner. Additionally, from the teachers' perspective, utilizing cloud platforms enables teachers to access comprehensive student data, including engagement metrics, quiz scores, and assignment submission timeframes, facilitating curriculum adjustments or the provision of supplementary resources for students in need of assistance. The same is also helpful to preserve extensive year-by-year data of students. Current research by Faisal et al. (2017) has asserted that cloud-based LMSs often practice data analytics and machine learning algorithms to screen student performance and suggest learning trajectories, so with this personalized method, one can facilitate student engagement with knowledge and their progress in the most efficient manner (Bennett et al., 2012). As we have already discussed, platforms such as Moodle, 360Learning, Canvas, and Google Classroom, by Instructure, use adaptive learning technology to provide personalized learning experiences and efficiently offer students suggestions based on their progress and previous interactions with the system (Sadiq & Ramzan, 2021).

Discussion

The use of cloud computing in LMSs has significantly transformed the educational environment. Although the advantages of cloud-based systems are well-documented, the obstacles related to security, infrastructure, and user adaptation persist as primary issues (Okai-Ugbaje et al., 2022). This section consolidates and critically evaluates the main outputs from the above-examined literature, which might be helpful to provide insights into the present condition of cloud computing in education, its aids, disadvantages, and potential developments. Undoubtedly, cloud computing has significantly transformed the functioning of educational institutions, distribution, and engagement with learning materials. Faisal et al. (2017) observed that the shift from conventional systems to cloud-based LMS platforms has democratized educational resources, making them more accessible, economical, free from geographical obstacles, and scalable for diverse institutions.

The scalability of cloud-based LMSs is a significant advantage for educational organisations. With the advancement of educational technology, the need for systems capable of managing large user bases and varied material has increased, which is mandatory to manage vast amounts of data of learners, trainers, and recorded educational content (Clark & Mayer, 2016). Cloud-based LMS platforms can accommodate universities with thousands or lakhs of students, enabling worldwide access to education. These platforms are designed in such a way that they are capable of providing the essential infrastructure for handling extensive data from learners, including individual-wise performance metrics, their interaction patterns, along with their demographic information, which are vital for customizing educational experiences (Abdul Halim & Luaran, 2024; Merdianti et al., 2023).

The findings of Sharma & Rawat (2020) have emphasized that cloud computing might be helpful to improve the adaptability and accessibility of educational institutions, which can be a great way of facilitating distant education and hybrid learning. The worldwide proliferation of online education during the COVID-19 epidemic has rendered cloud-based LMS solutions crucial for ensuring educational continuity (Agrawal, 2021). They have the potential to enable institutions to transition from in-person to virtual classrooms seamlessly, guaranteeing the continuity of educational services during crises. Qasem et al. (2019) assert that the cost-effectiveness of cloud-based systems significantly contributes to the accessibility of modern LMS solutions for underfunded universities (Merdianti et al., 2023). Among various positive impacts, Morrison and Ross (2021) have shown that the cost-effectiveness of cloud-based LMS might be a double-edged sword. Although the initial expenditure is low, the long-term expenses of cloud services may escalate, especially when managing substantial data storage, bespoke features, or large-scale implementations. There will be an urgent need for institutions to adopt a well-organized approach to controlling these persistent expenditures to avert financial hardship (Leong, 2020).

The results of the research of Sadiq and Ramzan (2021) have emphasized that data analytics incorporated into cloud-based learning provide instructors with real-time insights into student achievement. In addition to this, Faisal et al. (2017) have discovered that cloud-based LMSs has significantly enhance student engagement and performance, along with this, utilization of machine learning algorithms and artificial intelligence (AI), might provide further reading resources, quizzes, or instructional films for students experiencing difficulties in specific subjects (Cepeda et al., 2006; Merdianti et al., 2023).

Masrat (2014) has shown that the cloud-based systems provide extensive data, insufficient training, and data literacy among trainers and educators, which seems to impede the optimal utilization of these insights. Qasem et al. (2019) have stated that storing sensitive information, including personal identifiers, student grades, and financial data on third-party cloud servers poses a worry of data breaches and unauthorized access, as seen by many researchers. Faisal et al. (2017) have emphasized that the importance of adhering to data privacy rules, with the addition of the General Data privacy Regulation (GDPR) in the European Union and the Family Educational Rights and Privacy Act (FERPA) in the United States, in their systematic review, must be followed. These laws impose rigorous standards on the management and protection of student data by educational institutions. Although, for the security purpose, cloud providers often force to use encryption, firewalls, and other security methods to safeguard data but in some cases insufficient openness in data management processes may erode confidence and impede the adoption of cloud technology in education (Abdul Halim & Luaran, 2024; Clark & Mayer, 2016).

Furthermore, Masrat (2014)noted that some countries might face difficulties applying legal jurisdiction in cloud computing. There is always a possibility that data kept on a cloud provider's server in a foreign nation/foreign institution may be governed by distinct regulatory frameworks, possibly exposing students' personal information to risks of unauthorized access or exploitation (Bremner, 2010). This might result in comprehending the legal intricacies associated with data storage for educational institutions aiming to safeguard their students. Although without any doubt, cloud-based LMS solutions provide several advantages, the digital divide continues to pose a substantial obstacle to their implementation (Kaliisa et al., 2019). For example, in 2025, in several regions globally, particularly in poorer nations, dependable internet connectivity will be treated as a luxury. The study of Sharma & Rawat (2020) has exhibited that the students in rural or distant regions often face difficulties accessing cloud-based materials due to insufficient internet connection and a deficiency of contemporary computer equipment. On the other hand, with growing technologies, the incorporation of artificial intelligence (AI), big data analytics, and blockchain into cloud-based LMSs might significantly expand the educational experience (Elen & Depaepe, 2025; Gialamas et al., 2013; Pedro et al., 2018).

Possibly, the blockchain technology can be a way of an enhanced security framework by facilitating safe, transparent, and immutable records for academic accomplishments and credentials, guaranteeing that credentials are authenticated and impervious to alteration. This may alleviate some apprehensions about data integrity and fraud prevention in education (Slater & Wilbur, 1997). Ultimately, cloud computing will persist in its evolution and influence the future of education. As technology progresses and the worldwide need for adaptable, customized learning experiences increases, cloud-based LMSs will continue to lead this revolution (Pedro et al., 2018). To effectively harness the promise of cloud computing, educational institutions must confront issues such as security, digital disparity, and user adaptability while embracing the new opportunities presented by cloud-based platforms (Okai-Ugbaje et al., 2022).

Limitations of the Study

The integration of cloud computing in LMSs is systematically investigated in this paper. Still, many restrictions must be admitted, like the study primarily addresses higher education, excluding K–12 education and nontraditional learning environments where cloud adoption may have different effects and degrees. It does not include research from certain areas or nations where cloud computing in education could still be in its infancy, and their data is unavailable. The variety of cloud computing technologies being used in education (Udobia et al., 2024) presents another constraint. Every cloud-based LMS in use offers unique apps, tools, capabilities, and user interfaces (Okai-Ugbaje et al., 2022). The diversity suggests that the experiences of institutions utilizing various platforms are not exactly similar, so the general influence of cloud computing on education is shown inconsistently (Kaliisa et al., 2019).

Using a cloud-based LMS has immediate effects and short-term advantages; hence, a favourable amount of the research covered in this paper addresses these aspects. Still, the long-term consequences of cloud computing on institutional performance, learning outcomes, and instructional strategies are unclear (Merdianti et al., 2023). Some research has not been carried out for long enough to provide strong data on the lifetime and environmental impact of cloud-based technologies in learning environments. Using longitudinal data can help one ascertain if incorporating cloud-based LMS may result in ongoing enhancements in educational results (Kukulska-Hulme & Shield, 2018). There are also some possibilities that the publication bias, a phenomenon wherein studies with good outcomes are more commonly published, may distort the general conclusions of this study. Particularly concerning its scalability, accessibility, and cost-effectiveness, the examined literature is generally favourable on integrating cloud computing in education. Research on how regional and cultural settings affect the acceptance and effectiveness of cloud-based LMS in education (Leong, 2020; Udobia et al., 2024) should follow later on.

Conclusion

Cloud-based Learning Management Systems have transformed education by providing economical, flexible, efficient, scalable, and adaptable platforms that accommodate various teaching and learning requirements. Although, as discussed above, cloud computing provides many benefits, like tailored learning and enhanced collaboration, many issues persist about data security, infrastructure, and equal access. Confronting these obstacles is crucial for maximizing the advantages of cloud computing in education and providing accessibility for all students, irrespective of their location or socioeconomic status.

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