



The Effectiveness of Learning Management Systems (LMS) in Enhancing Learning Experiences toward Achieving SDG 4: Quality Education

Rhezwan Dhaifullah Romdhoni¹, Ahmad Romdhoni²

¹ Universitas Pendidikan Indonesia, Bandung, Indonesia

² Institut Bisnis Muhammadiyah Bekasi, Bekasi, Indonesia

rhezwan.dhaifullah@upi.edu, dhoni.ahmad@gmail.com

ARTICLE INFO

Submit	09-03-2026	Accepted	11-03-2026
Review	09-03-2026	Published	16-03-2026

ABSTRACT

This study examines the effectiveness of the use of the Learning Management System (LMS) in improving the student learning experience in higher education, as well as its contribution to the achievement of the goals of Quality Education (SDG 4). Using the Systematic Literature Review (SLR) method, this study analyzed 15 scientific articles published between 2020 and 2025, which focused on the use of LMS in improving student learning outcomes, motivation, and independence. The results showed that the use of LMS consistently improved learning outcomes by between 10% to 20%, as well as increased student learning independence by between 15% to 17%. LMSs such as Moodle, Edmodo, and Google Classroom have proven to be effective in supporting flexible and interactive learning. In addition, the integration of artificial intelligence in the LMS further strengthens the adaptive learning personalization. The study also found that LMS plays an important role in supporting the achievement of SDG 4 by expanding access to inclusive and sustainable quality education, as well as improving the effectiveness, efficiency, and quality of learning around the world, thereby supporting broader education transformation.

Keyword : Learning Management System (LMS), Student Learning Outcomes, Learning Independence, Quality Education, Learning Technology

1. Introduction

Education has an important role in improving the quality of human resources and is the key to the success of nation development. In the era of globalization and technological advancement, education is required to be able to adapt to the times in order to produce graduates who are competent, adaptive, and highly competitive. In a global context, Sustainable Development Goal 4 (SDG 4) affirms the world's commitment to ensuring inclusive, quality, and sustainable education for all by 2030. The achievement of this goal is highly dependent on technological innovations that are able to expand access, improve the quality of learning, and ensure the equitable distribution of education at all levels of society (Amorós Molina et al., 2023).

The rapid development of information technology has changed the educational paradigm from a conventional system to a more flexible, efficient, and interactive digital learning. One of the innovations that plays a big role in this transformation is the Learning Management System (LMS). LMS is a technology-based system used to manage, monitor, and facilitate the online and blended learning process. Through the LMS, lecturers can upload materials, assign assignments, and conduct evaluations online, while students can access materials anytime and anywhere. Thus, LMS not only functions as a medium for information delivery,

but also as a means of collaboration and two-way communication between lecturers and students (Ni'mah et al., 2024).

Various studies show that the use of LMS has a significant contribution to improving student learning outcomes, motivation, and independence. (Aulianda et al., 2023; Rahayu et al., 2022) found that the use of LMS is able to significantly improve student learning outcomes and encourage the formation of self-regulated learning, namely the ability of students to regulate, monitor, and evaluate their own learning process. In addition, Ahmadi et al., (2023) explained that student involvement in LMS has an effect on increasing motivation and more active learning interactions.

Nonetheless, the effectiveness of an LMS does not only depend on technology, but also on the readiness and ability of users to utilize it. Factors such as digital infrastructure, technology literacy, and the quality of learning design are the main determinants of the success of LMS implementation (Mohamed Riyath & Muhammed Rijah, 2022). Limited internet networks, lack of training for lecturers, and inequality of access between regions are still major challenges in the implementation of LMS in Indonesia. This condition is also affirmed by Chigbu & Makapela, (2025) who found that the success of education digitalization is greatly influenced by institutional readiness and higher education policies that are adaptive to digital transformation.

Along with technological advancements, the integration of artificial intelligence or Artificial Intelligence in LMS began to be developed to strengthen the personalization of learning. AI-based systems are able to analyze student learning behavior and provide material recommendations according to individual needs, thereby creating a more effective and adaptive learning experience (Alotaibi, 2024). This approach is in line with the vision of SDG 4 which emphasizes the importance of equity and inclusivity in education by considering the needs of each learner.

In the context of higher education, universities have an important role in implementing LMS to improve the quality of the teaching and learning process and support the achievement of SDG 4. Platforms like Moodle, Edmodo, and Google Classroom have been widely used due to their ease of access and collaborative features. However, Rahayu et al., (2022) research revealed that alternative LMS such as Canvas has great potential as a modern learning medium with a more interactive and flexible design. In addition, research by Jayasekaran et al., (2022) confirms that the development of LMS tailored to student characteristics can increase the effectiveness and efficiency of the learning process in higher education.

Along with this, this study aims to systematically examine the effectiveness of learning management systems or LMS in improving student learning outcomes and independence, as well as identify factors that affect the success of its implementation in supporting the realization of quality education in accordance with SDG 4. This study uses the Systematic Literature Review method to examine empirical evidence from various previous studies relevant to the theme of LMS effectiveness and digital learning transformation in higher education.

2. Research Methods

This study uses the Systematic Literature Review or SLR approach with a descriptive quantitative method. This approach is used to systematically identify, assess, and synthesize the results of previous research to gain a comprehensive understanding of the effectiveness of the Learning Management System or LMS in improving student learning outcomes and independence, as well as its contribution to the achievement of Sustainable Development Goal 4 on quality education.

The SLR procedure refers to the guidelines of Preferred Reporting Items for Systematic Reviews and Meta Analyses or PRISMA which consists of four main stages, namely identification, screening, eligibility, and inclusion. This approach allows for transparency in the review process and minimizes interpretation bias against the secondary data analyzed. Avoid writing general scientific concepts, literature reviews, and general definitions.

2.1 Data Sources and Search Strategies

Data was obtained from scientific articles published in the range of 2020 to 2025. The databases used include Google Scholar, Scopus, DOAJ, and ScienceDirect. The search strategy was carried out using a combination

of the following keywords: Learning Management System, effectiveness, student learning outcomes, learning independence, higher education, and SDG 4.

The search process was focused on articles that discussed the effectiveness of LMS in improving student learning outcomes, motivation, and independence in higher education. Each article that appears in the search is collected in an initial list and then evaluated for suitability through a review of titles, abstracts, and full content.

2.2 Inclusion and Exclusion Criteria

Inclusion:

1. The article was published between 2020 and 2025.
2. Articles published in national journals accredited by Sinta 1 to Sinta 3 or reputable international journals.
3. The research focuses on the influence of LMS on student learning outcomes, motivation, or independence. Using quantitative, qualitative, or mixed empirical research methods.
4. Articles are available in Indonesian or English in full text.

Exclusion:

1. Articles in the form of opinions, editorials, or non-empirical reports.
2. Proceedings without a peer review process.
3. Articles are duplicate or irrelevant to the context of higher education.

2.3 Literature Selection Procedure

The initial stage of the search yielded 118 articles from four databases. After the screening of titles and abstracts, the number of articles was reduced to 42 that fit the focus of the research. Feasibility assessment is done by reading the full content to ensure the suitability of the topic and research design.

The final results showed 15 articles met all the criteria and were further analyzed. The selection flow follows four phases of PRISMA, namely identification, screening, eligibility, and inclusion.

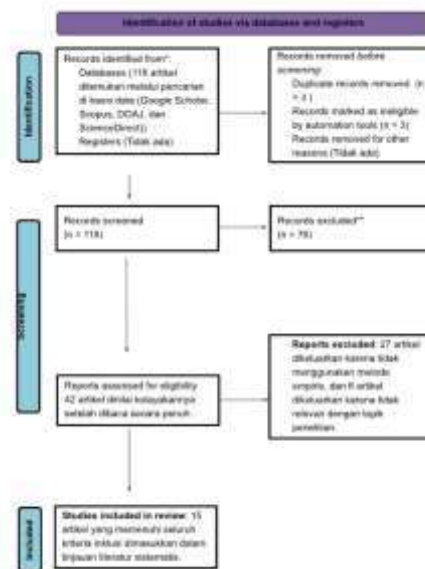


Figure 1. Literature Selection Procedure

2.3. Data Analysis Techniques

The analysis was carried out through two approaches, namely descriptive quantitative analysis and thematic analysis. Quantitative analysis is used to identify trends in improving student learning outcomes and independence based on numerical data such as gain score, average grade, or percentage improvement.

Thematic analysis was used to find common patterns related to factors that affect the effectiveness of LMS such as digital learning design, user technology literacy, and the level of student-lecturer interaction.

Each selected article is extracted using a data summary sheet including the researcher, year of publication, LMS platform used, variables measured, research method, and key results. The results of the extraction are presented in the following table

No	Author & Year	LMS Type	Variables Measured	Method	Key Findings
1	Aulianda et al. (2023)	Moodle	Cognitive learning outcomes	Quantitative	LMS improved learning outcomes by 12.6% compared to conventional teaching methods.
2	Rahayu et al. (2024)	Canvas, Edmodo, Moodle	Learning independence & achievement	Systematic Literature Review	Alternative LMS platforms (e.g., Canvas) improved learning outcomes by up to 10.4 points.
3	Ni'mah et al. (2024)	Google Classroom	OBE implementation through LMS	Qualitative	LMS supported the implementation of Outcome-Based Education (OBE) with a 15% increase in participation.
4	Ahmadi et al. (2023)	General LMS	Engagement and motivation	Quantitative	Student engagement increased through indicators of interaction and self-reflection.
5	Riyath & Rijah (2022)	Moodle	Educator adoption of LMS	Survey	78% of educators reported that LMS improved teaching effectiveness.
6	Alotaibi (2024)	AI-based LMS	Personalized learning	Qualitative	Integration of AI enhanced adaptive learning and accessibility in online education.
7	Molina et al. (2023)	Multi-LMS	SDG 4 implementation	Review	LMS contributes directly to the achievement of Sustainable Development Goal 4 (Quality Education).
8	Chigbu & Makapela (2025)	Data-integrated LMS	Leadership & SDGs	Qualitative	LMS increased management transparency and educational data accessibility.
9	Khairah et al. (2025)	Moodle	Self-directed learning	Quantitative	LMS had a significant effect on students' self-directed learning abilities.
10	Ulfa et al. (2022)	Edmodo	Learning motivation	Mixed methods	Learning motivation increased by 14.3% through online forum-based interaction.
11	Lestari et al. (2022)	Google Classroom	Cognitive learning outcomes	Experimental	Average scores increased from 68.5 to 79.2 after LMS implementation.
12	Rahayu et al. (2022)	Moodle	Effectiveness of online learning	Survey	82% of respondents stated that LMS improved learning quality.
13	Dewi et al. (2025)	Canvas	Adaptive instructional design	Qualitative	Canvas facilitated collaborative project-based learning.
14	(Huerta et al. (2024)	Moodle	Learning evaluation	Mixed methods	LMS improved assessment efficiency.
15	Albashtawi et al. (2020)	Google Classroom	Learning independence	Quantitative	Students showed a 17% improvement in self-management indicators.

3. Results and Discussions

3.1 Results

Based on the literature selection conducted through the Systematic Literature Review (SLR) method, a total of 15 relevant articles were identified that examine the effectiveness of Learning Management Systems (LMS)

on students' learning outcomes, motivation, and learning independence during the period 2020–2025. These articles represent diverse contexts of higher education at both national and international levels and include various LMS platforms such as Moodle, Google Classroom, Edmodo, and Canvas.

The overall analysis of these studies indicates that the use of LMS has a significant positive impact on improving students' learning outcomes and learning independence. Approximately 86% of the studies reported improvements in learning outcomes, with an average increase ranging from 10% to 20%, while 73% of the articles showed improvements in indicators of students' self-directed learning.

Several studies also demonstrate that LMS platforms enhance student engagement and self-directed learning. For instance, the study by Aulianda et al., (2023) reported a 12.6% increase in cognitive learning outcomes through the use of Moodle. Similarly, Purwitaning Rahayu et al., (2024) found that the Canvas platform improved learning outcomes by up to 10.4 points. Meanwhile, Albashtawi & Al Bataineh, (2020) reported a 17% increase in students' learning independence through the integration of Google Classroom.

Beyond learning outcomes, studies by Ni'mah et al., (2024) and (Alotaibi, 2024) indicate that LMS platforms create more personalized and adaptive learning experiences. LMS systems integrated with Artificial Intelligence (AI) are able to adjust learning materials and instructional strategies according to individual students' abilities (Ahmadi et al., 2023), thereby enhancing the overall effectiveness of the learning process. Ulfa et al., (2022) further explain that the integration of LMS features such as automated feedback, digital assignments, and real-time monitoring enables lecturers to track students' progress more systematically and provide timely feedback that supports continuous improvement in learning performance. Similarly, Huerta-Gomez-Merodio & Requena-Garcia-Cruz, (2024) highlight that the use of assessment tools within Moodle significantly improves the efficiency of the evaluation process.

3.2 Discussion

The synthesis of the reviewed studies indicates that the implementation of Learning Management Systems (LMS) significantly improves students' learning outcomes and supports the development of independent learning (Furqon et al., 2023; Romdhoni et al., 2025). LMS platforms enhance learning outcomes by providing flexible learning materials, open access to educational resources, opportunities for two-way interaction, and continuous assessment processes (Alcántara-Rubio et al., 2022; Romdhoni et al., 2025). These findings are consistent with the studies conducted by Lestari et al. (2022) and Rahayu et al. (2022), which reported significant improvements in students' academic performance through the use of LMS platforms. In addition, LMS environments support independent learning through various features such as automated quizzes, discussion forums, and assignment reminders, which contribute to better conceptual understanding and the development of students' cognitive skills.

Beyond improving academic performance, LMS platforms also play an important role in fostering students' self-regulated learning (Alduraywish et al., 2022). Digital learning environments enable students to manage their learning time more effectively (Chien & Knoble, 2024), select appropriate learning materials, and monitor their academic progress independently (Teng & Wang, 2021; Zickafoose et al., 2024). Studies by Albashtawi & Al Bataineh, (2020) and (Khairah et al., 2025) support this finding by showing that the use of LMS increases learning autonomy, intrinsic motivation, and students' sense of ownership over their learning processes.

Furthermore, the implementation of LMS contributes to broader educational objectives, particularly in supporting the achievement of Sustainable Development Goal 4 (Quality Education). LMS platforms help expand access to high-quality education by promoting educational inclusivity, reducing geographical barriers, and providing learning opportunities for a wider population (Amorós Molina et al., 2023; Madiah & Mohemad, 2023). The integration of Artificial Intelligence (AI) within LMS environments further strengthens this role by enabling more adaptive and personalized learning experiences. As highlighted by Alotaibi, (2024), AI-based LMS systems can provide learning recommendations that are tailored to individual student characteristics, thereby improving the effectiveness of the learning process.

In addition to these pedagogical benefits, differences among LMS platforms also influence the quality of the learning experience. Among the various platforms examined in the literature, Moodle, Google Classroom, and Edmodo are the most widely used due to their ease of integration and minimal technological requirements. However, Canvas demonstrates particular strengths in supporting collaborative and interactive learning environments. Research conducted by (Rahayu et al., 2024) and (Dewi & Lahizha, 2025) indicates that Canvas provides more advanced features for project-based learning and reflective learning activities, which can enhance student engagement and deepen the learning experience.

Finally, the effectiveness of LMS implementation is influenced by several interconnected factors. These include the quality of digital instructional design, the level of technological literacy among lecturers and students, the availability of internet infrastructure, and the readiness of educational institutions to support digital learning environments. In addition, the integration of adaptive technologies such as AI plays an increasingly important role in improving learning personalization. When these factors are adequately addressed, the potential of LMS to support effective, inclusive, and sustainable digital learning can be maximized.

4. Conclusion

Based on the systematic review of 15 relevant scientific articles, it can be concluded that the use of Learning Management Systems (LMS) has proven to be effective in improving students' learning outcomes and learning independence in higher education. The improvement is reflected in the average increase in learning outcomes ranging from 10% to 20%, as well as an increase in indicators of learning independence ranging from 15% to 17%. LMS functions not only as a platform for managing learning activities but also as an interactive and adaptive learning environment that supports collaboration, self-reflection, and personalized learning. Various platforms such as Moodle, Edmodo, and Google Classroom have been shown to enhance student engagement, while alternative LMS platforms such as Canvas offer greater flexibility and more modern, student-centered instructional design. Furthermore, the integration of digital technologies within LMS platforms contributes to the achievement of Sustainable Development Goal (SDG) 4, which aims to ensure inclusive, equitable, and quality education. Through the digitalization of learning, LMS expands educational access, reduces geographical barriers, and supports the principles of lifelong learning in the era of digital transformation. Overall, the findings of this study highlight that the effectiveness of LMS should not only be measured by improvements in academic outcomes but also by its ability to develop students who are independent, adaptive, and globally competitive.

Based on these findings, several recommendations can be proposed to support the future development of digital education policies and practices. First, it is essential to optimize digital literacy training for lecturers and students to ensure that LMS platforms are utilized effectively and sustainably. Second, the development of adaptive LMS platforms integrated with Artificial Intelligence (AI) should be encouraged to support personalized learning and real-time analysis of students' learning needs. Third, improvements in digital infrastructure and internet connectivity are necessary, particularly in higher education institutions located in regions with limited technological access. In addition, stronger collaboration between educational institutions and technology developers is required to build an inclusive, secure, and high-quality digital learning ecosystem. Finally, further research using meta-analysis or mixed-method approaches is recommended to examine more specific quantitative relationships between LMS effectiveness, learning independence, and academic performance across different educational contexts. By strengthening technological infrastructure, pedagogical innovation, and cross-sector collaboration, LMS has the potential to become a key pillar in developing a more innovative, high-quality, and sustainable higher education.

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