Multidisciplinary Output Research For Actual and International Issue (MORFAI Journal) ISSN (e): 2808-6635
Volumes 5 No. 2 (2025)

EVOLUTION OF LEARNING SYSTEMS: FROM LEARNING MANAGEMENT SYSTEMS TO ADAPTIVE LEARNING SYSTEMS BASED ON ARTIFICIAL INTELLIGENCE

Bahrul Alam[1], Ahmad Kosim[2], Eny Ermawaty[3], Sarwiyanti[4]
[1,2,3,4]Universitas Muhammadiyah Jakarta
Email: bahrullalam@gmail.com[1] ahmadkosim.iibs@gmail.com[2], earthgirl@rocketmail.com[3] sarwie15@gmail.com[4]

Received	: 21 March 2025	Published	: 15 May 2025
Revised	: 29 March 2025	DOI	: https://doi.org/10.54443/morfai.v5i2.2874
Accepted	: 11 April 2025	Publish Link	: https://radjapublika.com/index.php/MORFAI/article/view/2874

Abstract

Digital transformation in education has driven a paradigm shift from the use of Learning Management Systems (LMS) to the development of Adaptive Learning Systems (ALS) based on artificial intelligence (AI). This article aims to examine the evolution of this learning system through a literature study approach to 16 national and international scientific articles in the 2015–2025 period. The results of the study indicate that the integration of AI in the learning system strengthens personalization, student engagement, and the effectiveness of learning outcomes. LMS, which previously functioned as a managerial and content distribution platform, has now evolved into an ALS that is adaptive and responsive to the characteristics of individual learners. However, this transition process is not without challenges, including the need for representative training data, readiness of technological infrastructure, and issues of data ethics and privacy. This study recommends an integrative and inclusive strategy in the implementation of AI-based ALS, in order to realize a dynamic, personal, and sustainable digital learning ecosystem.

Keywords: ***Learning Management System, Adaptive Learning System, Artificial Intelligence, educational technology, personalization of learning.***

INTRODUCTION

Developments in the field of information and communication technology have resulted in significant changes in various aspects of life, including in the education sector. One manifestation of this change is the implementation of a digital learning system, which currently plays a crucial role in the modern education process. The Learning Management System (LMS) is one of the early forms of educational digitalization, which has been widely used by educational institutions to manage materials, assignments, and interactions between teachers and students. While LMSs provide convenience in learning management, they still have limitations in terms of adaptability and personalization of learning. Along with the advancement of artificial intelligence (AI) technology, adaptive learning systems (ALS) were born. The transition from LMS to ALS is a significant evolution in educational technology, driven by the need for a more personalized and flexible learning experience. LMSs typically serve as platforms for delivering educational content and managing administrative tasks, offering limited personalization features that often do not fit individual learning styles or needs. In contrast, ALSs leverage advances in artificial intelligence to provide responsive learning environments that adjust content and pace to suit the unique needs of each learner. Recent studies highlight the transformative potential of AI in education, particularly in creating adaptive learning frameworks that increase student engagement and improve learning outcomes.

The implementation of an AI-based LMS emphasizes its capacity to provide a highly personalized learning experience that is tailored to the individual's learning style and pace.(Pardosi et al., 2024). Marzuki et al. further added that adaptive learning can optimize educational materials based on students' strengths and weaknesses, thereby encouraging a more in-depth learning experience.(Marzuki et al., 2024).An effective adaptive learning environment also depends on understanding the diverse learning behaviors of students and responding appropriately to them.(Cavanagh et al., 2020).Adaptive learning systems can efficiently implement recommendation engines that provide educational resources to suit and can overcome problems related to presenting irrelevant content to

learners.(Kaiss et al., 2023).By leveraging AI, ALS enables the creation of more personalized, responsive, and data-driven learning, thereby increasing the efficiency and effectiveness of the teaching and learning process.

This paper aims to explore the development of learning systems from Learning Management Systems (LMS) to Adaptive Learning Systems (ALS) supported by artificial intelligence. The discussion will focus on the differences in characteristics between the two systems, the challenges faced during the transition process, and the potential that can be utilized to create a more adaptive and inclusive digital learning ecosystem. With a deep understanding of these developments, it is hoped that stakeholders in the world of education can formulate effective strategies to integrate intelligent technology into the learning system.

METHOD

This type of research uses a literature study method (library research) to trace and analyze the evolution of the learning system from Learning Management System (LMS) to Adaptive Learning System (ALS) based on artificial intelligence (Artificial Intelligence/AI). Literature study was chosen because this article aims to build a comprehensive conceptual and theoretical understanding of the topic discussed, not to test the hypothesis empirically. The subjects of this study used 15 national / international articles that discussed the evolution of the learning system from Learning Management System (LMS) to Adaptive Learning System (ALS) based on artificial intelligence (Artificial Intelligence/AI).

The research design applied in this literature study uses a narrative review that combines theory, analyzes existing research, and explores the methods used in the study. This review process aims to collect various perspectives from existing literature on a particular topic and organize them in an organized interpretation, with an emphasis on key issues.

Data were obtained from national and international indexed journal articles (Google Scholar, SINTA, proceedings, research reports, and relevant official documents by typing the keywords Learning Management System, Adaptive Learning System, Artificial Intelligence. The articles searched were mainly those published in the last 10 years (2015-2025).

The results of the validation and review process of scientific articles are presented in table format. To analyze the data, a qualitative analysis approach developed by Miles and Huberman was used, which includes the steps of data reduction, data analysis, and drawing conclusions.

RESULTS

After conducting a search through literature studies, 16 articles were obtained published in National or International Journals in the period 2015-2025. Several articles were found that were relevant or discussed related to the discussion of the evolution of learning systems, Learning Management Systems, Adaptive Learning Systems and Artificial Intelligence.

No	Writer	Journal Title	Year	Review Results
1	Blasa Celerina Cruz Cabrera, Maricela Castillo Leal, Jorge Antonio Silvestre Acevedo Martínez, Ana Luz Ramos Soto, Jovany Sepulveda, Jackeline Valencia, Luis Fernando Garcés-Giraldo, Alejandro Valencia Arias	Artificial Intelligence (AI) and Learning Management Systems (LMS): A bibliometric analysis	2025	The purpose of this study was to examine the research trends on the use of AI in LMS. The results showed a quadratic polynomial growth of 99.42%, with the years 2021 and 2015 representing the most significant growth. Thematic references included authors such as Li J and Cavus N, the journal Lecture Notes in Computer Science, and countries such as China and India. The analysis revealed that emerging and developing words such as Learning Styles and Learning Management Systems deserve further investigation. The development of a future research agenda emerged as a major need to address the gap(Cabrera et al., 2025)
2	Victor Benny Alexsius Pardosi,	Implementation Of An Artificial	2024	This study aims to develop and implement an artificial intelligence-based learning management

No	Writer	Journal Title	Year	Review Results
	Shanshan Xu, Ulfah Usiaohmi, Nurdiana Nurdiana, Fatmawati Sabur	Intelligence Based Learning Management System For Adaptive Learning		system to personalize learning. The results of the study indicate that this AI-based learning management system successfully increases student engagement and provides effective learning personalization. Data shows an increase in grades and understanding of the material, especially in concepts that were previously considered difficult for students. Implementing an artificial intelligence-based learning management system has proven to be effective in supporting adaptive learning. This study also identified several challenges including the need for more significant and varied training data and smoother integration with the school curriculum.(Pardosi et al., 2024)
3	Ilie Gligorea, Marius Cioca, Romana Oancea, Andra Teodora Gorski, Hortensia Gorski and Paul Tudorache	Adaptive Learning Using Artificial Intelligence in e-Learning: A Literature Review	2023	This study aims to map the use of e-learning for adaptive learning, describe the benefits and challenges of such integration, and assess its impact on student engagement, retention, and performance. The findings reveal that AI algorithms play a significant role in personalizing the learning experience. This technology has been shown to optimize learning pathways, increase engagement, and improve academic performance, with some studies reporting improved test scores. Integration of AI/ML in e-learning platforms make significant contributions to the personalization and effectiveness of the educational process. Despite challenges such as data privacy and the complexity of AI systems, the results underscore the potential of adaptive learning to revolutionize education by meeting the needs of individual learners.(Gligorea et al., 2023)
4	Marzuki, Nanang Zakaria, Masruri Masruri	Investigating The Capabilities Of Adaptive Learning As A Cutting-Edge Approach To Model Development In An Educational Setting	2024	Adaptive learning can be an innovative educational development model, according to this study. Interviews, observations, and data analysis were used in this study. The results showed that teachers, students, and parents have different perspectives on adaptive learning. They also indicated that there are technical and practical problems faced when implementing it. In addition, this study showed that adaptive learning has significant potential to improve educational effectiveness and inclusion. Adaptive learning also requires appropriate support and strategies to be successful.(Marzuki et al., 2024)
5	N Morze, L Varchenko-Trotsenko, T Terletska and E Smyrnova-Trybulska	Implementation of adaptive learning at higher education institutions by means of Moodle LMS	2021	To make the learning process fit the needs of students, adaptive learning can be introduced in higher education institutions. Adaptive learning is a methodology that allows to identify the level of knowledge of students and their learning styles and to change the materials, tasks and delivery methods according to the needs of the participants in the learning process. Moodle LMS offers various

No	Writer	Journal Title	Year	Review Results
				solutions for adaptive learning. They provide tools for administrators and teachers to vary all stages of the learning process, from the delivery of information to the assessment.(Morze et al., 2021)
6	Andhika, Amalia Shifa Aldila, Lawrence Adi Supriyono, Cantika Nur Previana, Dedi Rahman Habibie	The Effectiveness of Adaptive Learning Systems Integrated with LMS in Higher Education	2024	The purpose of this study was to evaluate how well an ALS combined with an LMS can improve student engagement, academic achievement, and overall satisfaction in higher education institutions. Integration of an adaptive learning system into an LMS platform showed that it improved student engagement, academic achievement, and overall satisfaction. According to these findings, educational institutions should consider adopting an ALS-integrated LMS if they want to support personalized learning and improve learning outcomes. Further research is needed to examine the impact and scalability of such systems across educational contexts in the long term. (Andhika et al., 2024)
7	Khalid Almohammadi, Hani Hagras, Daniyal Alghazzawi, Ghadah Aldabbagh	A Survey Of Artificial Intelligence Techniques Employed For Adaptive Educational Systems Within E-Learning Platforms	2017	Adaptive education systems in e-learning platforms are built in response to the fact that the learning process is different for each learner. The results obtained, this learner model can be used in two ways. The first is to inform the pedagogy proposed by experts and designers of adaptive education systems. The second is to provide the system with dynamic self-learning capabilities from the behaviors demonstrated by teachers and students to create appropriate pedagogies and automatically adjust the e-learning environment to suit the pedagogy. In this case, artificial intelligence techniques are useful for several reasons, including their ability to develop and imitate human reasoning and decision-making processes (teaching-learning models) and minimize sources of uncertainty to achieve an effective teaching-learning context.(Colchester et al., 2017)
8	Souha Bennani, Ahmed Maalel, Henda Ben Ghézala	Adaptive Gamification In E-Learning: A Literature Review And Future Challenges	2021	This study discusses the need to understand the dynamics of gamification that effectively engages learners, highlighting the importance of adapting learning experiences to individual characteristics such as personality needs and motivations. By integrating AI with adaptive gamification, this study suggests innovative techniques needed to create personalized learning environments.(Bennani et al., 2022)
9	Fahdarina Mahligawati, Edith Allanas, Maria Haryanti Butarbutar, NAN Nordin	Artificial Intelligence In Physics Education: A Comprehensive Literature Review	2023	This study aims to explore the basic concepts of AI, its various applications in physics learning, and the benefits and challenges associated with its implementation. Through a systematic search of academic databases, a collection of relevant research articles, journals, conference papers, and

No	Writer	Journal Title	Year	Review Results
				books related to AI in physics education was obtained. The study findings highlight the positive impact of AI in enhancing conceptual understanding, providing personalized instruction, encouraging social interaction, and improving assessment methods. However, challenges in terms of technical infrastructure, teacher training, data privacy, and ethical considerations were also identified. Recommendations for future research that address these challenges and encourage effective implementation of AI technologies in physics education are recommended.(Mahligawati et al., 2023)
10	Zamzami Zainuddin, Hardika Dwi Hermawan, Febritesna Nuraini, Santo Mugi Prayitno	Students' Learning Experiences With Lms Tes Teach In Flipped-Class Instruction	2019	The purpose of this study is to identify the impact of implementing Learning Management System (LMS) 'TES Teach' on students' learning experience in computer-assisted language learning (CALL) courses with flipped classroom instruction. The findings of this study indicate that LMS TES Teach is recommended to be implemented in CALL teaching for higher education in Indonesia. This study recommends that the Ministry of Research, Technology and Higher Education or policy makers in Indonesia including instructors, students, and community members should be actively involved in developing, supporting, and maintaining a learning culture that changes from traditional to technology-based learning environments.(Zainuddin et al., 2019)
11	Kuok Ho Daniel Tang	Implications Of Artificial Intelligence For Teaching And Learning	2024	Research shows that AI introduces new opportunities to create intelligent content that enhances the learning experience, encourages interactivity, and student-centered approaches. Intelligent content allows instructors to integrate multimedia interactive tools, AI-related wearables, and information technologies, diversifying learning modes and engaging students more effectively. While AI brings significant benefits, it is not without limitations. Challenges include infrastructure requirements, inclusion and equity considerations, teacher readiness and preparation, data quality and inclusivity, profit orientation, data privacy and ethical issues, and potential for unequal access. Addressing these limitations is critical to maximizing the positive impact of AI in education.(Tang, 2024)
12	Elkin Arturo Betancourt Ramírez, Juan Antonio Fuentes Esparrell	Artificial Intelligence (Ai) In Education: Unlocking The Perfect Synergy For Learning	2024	The synergy between repositories and artificial intelligence significantly enhances the ability to find, analyze, and manage academic information. This combination holds great promise as a strategy to increase efficiency and accuracy in the university research process. In conclusion, the

No	Writer	Journal Title	Year	Review Results
				exploration of AI in education reveals a promising future. The integration of technology into teaching enhances learning, making AI a valuable ally for the advancement and evolution of higher education.(Betancourt Ramirez & Fuentes Esparrell, 2024)
13	Xanthe Hunt, Mark Tomlinson, Siham Sikander, Sarah Skeen, Marguerite Marlow, Stefani Du Toit, Manuel Eisner	Artificial Intelligence Big Data And Mhealth: The Frontiers Of The Prevention Of Violence Against Children	2020	This paper discusses the significant potential of Artificial Intelligence (AI) and related technologies in addressing pressing global issues particularly in low- and middle-income countries (LMICs). The review emphasizes the need for effective data collection and modeling that parallels the evolution of LMS to Adaptive Learning Systems that leverage big data to enhance personalized learning experiences minimizing human error in instructional decisions and facilitating scalable solutions. The ethical considerations and investment required to develop such systems outlined in this paper further underscore the complexities involved in the transition from traditional LMS to more advanced adaptive systems based on AI.(Hunt et al., 2020)
14	Paulo Blikstein, Yipu Zheng, Karen Zhuqian Zhou	Ceci N'est Pas Une École: Discourses Of Artificial Intelligence In Education Through The Lens Of Semiotic Analytics	2022	This paper addresses the task of evolving a Learning Management System (LMS) into an Adaptive Learning System based on Artificial Intelligence (AI) by exploring the implications of AI in education. It highlights how AI technologies are reshaping the language and narratives around educational practices moving away from traditional notions of learning to more nuanced understandings that have the potential to enhance personalization and adaptability in learning environments. The article critiques the narratives promoted by AI in Education (AIEd) companies suggesting the need for a deeper evaluation of how AI-driven systems can introduce new forms of learning and assessment that go beyond basic individualization. The article highlights the potential of AI to drive adaptive learning beyond mere customization that aligns with the goal of transforming LMSs into more dynamic and responsive educational frameworks.(Blikstein et al., 2022)
15	Oleksandra Karmaza, SO Koroied, Vitalii M. Makhinchuk, Valentyna Yu. Strilko, Solomiia T. Iosypenko	Artificial Intelligence In Justice	2021	This article aims to discuss the main definitions of the concept of artificial intelligence, its origin, characteristics, the basis of its application, as well as its interaction and direct influence on the implementation of the main tasks of the judiciary through the use and development of artificial intelligence in judicial procedures. The article investigates the emergence and transformation of artificial intelligence in the context of modern technologies and information, its gradual

No	Writer	Journal Title	Year	Review Results
				introduction into various spheres of life, namely the ways of its application and the possibilities of its application in the judiciary.(Karmaza et al., 2021)
16	Muhammad Rehan Anwar	Ai-Powered Arabic Language Education In The Era Of Society 5.0	2023	This study aims to explore the potential use of AI in Arabic language teaching by understanding how this technology can facilitate more adaptive, interactive, and efficient learning according to the needs of each student. This study provides an in-depth understanding of how AI can be tailored to the learning needs of each student in the context of Arabic language education. Overall, this study not only provides new insights into the integration of AI in Arabic language education but also provides a foundation for the development of a responsive and adaptive curriculum in the era of Society 5.0.(Anwar & Ahyarudin, 2023)

DISCUSSION

Based on the results of the review of the table containing 16 (sixteen) scientific articles on the application of artificial intelligence in learning systems, it can be concluded that there is a significant trend towards the integration of AI technology in Learning Management Systems (LMS). Several studies highlight the exponential growth of research in this domain (Cabrera et al., 2025), as well as the success of AI implementation in strengthening aspects of personalization, student engagement, and the effectiveness of adaptive learning (Pardosi et al., 2024; Gligorea et al., 2023). Thus, the transition from conventional LMS to a more sophisticated and adaptive AI-based learning system is inevitable in answering the needs of 21st century education.

In addition, analysis of various studies shows that adaptive learning systems integrated with AI not only improve academic outcomes but also present new challenges. These challenges include the need for representative training data, integration that is aligned with the curriculum, readiness of technological infrastructure, and ethical issues such as privacy and inclusion (Tang, 2024; Marzuki et al., 2024). On the other hand, the use of AI in gamification-based learning, language teaching, and higher education shows that adaptive approaches can be adjusted to the characteristics and needs of individual learners, including psychological aspects such as motivation (Bennani et al., 2022; Anwar & Ahyarudin, 2023).

When viewed within the framework of the evolution of learning systems from Learning Management Systems to Artificial Intelligence-based Adaptive Learning Systems, this entire article represents a systemic transformation process in the world of digital education. LMS, which previously functioned as an administrative and content distribution tool, has now evolved into an intelligent, dynamic, and learner-oriented Adaptive Learning System (ALS). This evolution marks a paradigm shift from a uniform instructional system to a data-driven approach and deep personalization, in line with the principles of AI-based education that is adaptive and responsive to the diversity of learner needs.

CONCLUSION

Based on the results of the literature review in this journal, it can be concluded that the evolution of the learning system from Learning Management System (LMS) to Adaptive Learning System (ALS) based on Artificial Intelligence (AI) reflects a fundamental transformation in the approach to digital education. LMS, which originally functioned as an administrative and content distribution tool, has now shifted to an intelligent and dynamic system, capable of adjusting learning materials and strategies to the unique needs of each individual. The studies reviewed show that the integration of AI in the learning system has a positive impact on increasing student engagement, personalization, and academic achievement. This process shows a paradigm shift from a uniform instructional system to more responsive and inclusive data-driven learning.

However, this transition also comes with complex challenges. Various studies have noted the need for representative training data, infrastructure readiness, and curriculum adjustments to ensure the effectiveness of AI implementation in education. In addition, ethical issues such as data privacy, equal access, and educator readiness are

important concerns in the implementation of adaptive learning systems. However, the potential for AI utilization is not only limited to increasing learning efficiency, but also paving the way for a more holistic and learner-centered approach to education. Therefore, the integration of AI-based ALS requires a comprehensive strategy in order to create a sustainable and effective digital learning ecosystem for all stakeholders.

REFERENCES

Andhika, A., Aldila, A.S., Supriyono, L.A., Previana, C.N. & Habibie, D.R. 2024. The Effectiveness of Adaptive Learning Systems Integrated with LMS in Higher Education. *Jurnal KomtekInfo*, 49–56.

Anwar, M.R. & Ahyarudin, H.A. 2023. AI-Powered Arabic Language Education in the Era of Society 5.0. *IAIC Transactions on Sustainable Digital Innovation (ITSDI)*, 5(1): 50–57.

Bennani, S., Maalel, A. & Ben Ghezala, H. 2022. Adaptive gamification in E-learning: A literature review and future challenges. *Computer Applications in Engineering Education*, 30(2): 628–642.

Betancourt Ramirez, E.A. & Fuentes Esparrell, J.A. 2024. Artificial Intelligence (AI) in Education: Unlocking the Perfect Synergy for Learning. *Educational Process International Journal*, 13(1).

Blikstein, P., Zheng, Y. & Zhou, K.Z. 2022. Ceci n'est pas une école: Discourses of artificial intelligence in education through the lens of semiotic analytics. *European Journal of Education*, 57(4): 571–583.

Cabrera, B.C.C., Leal, M.C., Martínez, J.A.S.A., Soto, A.L.R., Sepulveda, J., Valencia, J., Garcés-Giraldo, L.F. & Valencia-Arias, A. 2025. Artificial Intelligence (AI) and Learning Management Systems (LMS): A bibliometric analysis. *Journal of Infrastructure, Policy and Development*, 9(1): 8029.

Cavanagh, T., Chen, B., Lahcen, R.A.M. & Paradiso, J. 2020. Constructing a Design Framework and Pedagogical Approach for Adaptive Learning in Higher Education: A Practitioner's Perspective. *The International Review of Research in Open and Distributed Learning*, 21(1): 172–196.

Colchester, K., Hagras, H., Alghazzawi, D. & Aldabbagh, G. 2017. A Survey of Artificial Intelligence Techniques Employed for Adaptive Educational Systems within E-Learning Platforms. *Journal of Artificial Intelligence and Soft Computing Research*, 7(1): 47–64.

Gligorea, I., Cioca, M., Oancea, R., Gorski, A.-T., Gorski, H. & Tudorache, P. 2023. Adaptive Learning Using Artificial Intelligence in e-Learning: A Literature Review. *Education Sciences*, 13(12): 1216.

Hunt, X., Tomlinson, M., Sikander, S., Skeen, S., Marlow, M., du Toit, S. & Eisner, M. 2020. Artificial Intelligence, Big Data, and mHealth: The Frontiers of the Prevention of Violence Against Children. *Frontiers in Artificial Intelligence*, 3.

Kaiss, W., Mansouri, K. & Poirier, F. 2023. Towards a Chatbot-Based Learning Object Recommendation: A Comparative Experiment. 159–170.

Karmaza, O.O., Koroied, S.O., Makhinchuk, V.M., Strilko, V.Yu. & Iosypenko, S.T. 2021. Artificial intelligence in justice. *Linguistics and Culture Review*, 5(S4): 1413–1425.

Mahligawati, F., Allanas, E., Butarbutar, M.H. & Nordin, N.A.N. 2023. Artificial intelligence in Physics Education: a comprehensive literature review. *Journal of Physics: Conference Series*, 2596(1): 012080.

Marzuki, M., Zakaria, N. & Masruri, M. 2024. Investigating the Capabilities of Adaptive Learning as a Cutting-Edge Approach to Model Development in an Educational Setting. *JKPP*, 1(3): 195–206.

Morze, N., Varchenko-Trotsenko, L., Terletska, T. & Smyrnova-Trybulska, E. 2021. Implementation of adaptive learning at higher education institutions by means of Moodle LMS. *Journal of Physics: Conference Series*, 1840(1): 012062.

Pardosi, V.B.A., Xu, S., Umurohmi, U., Nurdiana, N. & Sabur, F. 2024. Implementation of an Artificial Intelligence Based Learning Management System for Adaptive Learning. *Al-Fikrah Jurnal Manajemen Pendidikan*, 12(1): 149.

Tang, K.H.D. 2024. Implications of Artificial Intelligence for Teaching and Learning. *Acta Pedagogia Asiana*, 3(2): 65–79.

Zainuddin, Z., Hermawan, H.D., Nuraini, F. & Prayitno, S.M. 2019. Students' Learning Experiences With LMS Tes Teach In Flipped-Class Instruction. *Elinvo (Electronics, Informatics, and Vocational Education)*, 4(1): 1–11.