



Enhancing Personalized E-Learning Systems in Higher Education Through Artificial Intelligence: A Rapid Systematic Literature Review

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ABSTRACT

Traditional teaching and learning approaches have been supplanted by artificial intelligence (AI) in the education sector. The existing AI technologies that can be used for personalized learning, however, are not well understood. Moreover, a systematic literature review (SLR) of AI technology for personalized learning is not widely available. By performing a thorough literature review and presenting the findings of AI technologies for improving personalized learning, this work fills this research gap. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) model served as the basis for the SLR. This study included 32 English-language journal articles that were published in the Google scholar, IEEE and Springer Nature Link databases between 2020 and 2026. The study's findings indicate that a number of issues with the current e-learning systems, including critical thinking, dependency syndrome, data privacy issues, and a lack of data privacy, make it challenging to accomplish personalized learning. The study also identified a number of AI technologies that fall within the general categories of deep learning (DL) and machine learning (ML). Both educational practice and the application of educational policies are impacted by these findings.

Keywords: Artificial Intelligence, Higher education, Personalized learning, e-learning, Higher Education

INTRODUCTION

Traditional teaching and learning approaches were widely used and the mainstay of education delivery worldwide until the COVID-19 epidemic. Although these approaches were essential to education, they have drawbacks, including being teacher-centric (Iqbal et al. 2025; Balalle, 2025), static (Gutierrez et al., 2025), linear, restricted to physical classrooms, fixed learning schedules (Javier, Fombona, 2020), and relying on printed educational materials (Murtaza et al., 2025). These drawbacks led to the development of e-learning platforms, which are supported by learning management systems (LMS) such as Sakai, Blackboard, and Moodle and have been incorporated into conventional teaching techniques. These developments in e-learning also brought with them new difficulties, such as a lack of resources (Yusoff et al., 2025).

The nature of traditional and e-Learning systems had a severe impact on the education industry when the COVID-19 epidemic broke out. The mobility constraints imposed by the COVID-19 epidemic prompted a shift from traditional brick-and-mortar classrooms to entirely online schooling. Despite their strengths, present e-learning systems have limitations in their performance; for example, both traditional education techniques and conventional e-learning systems have limitations in their ability to create personalized learning experiences (Shin et al., 2024). Furthermore, there are few studies that illustrate these constraints and the prospects of deploying AI-driven e-Learning systems (Carnovalini et al., 2025).

The focus of existing systematic literature reviews (SLR) is either limited to a single type of AI technology, such as ChatGPT (Hamad et al., 2024), Generative AI (Dhananjaya et al., 2024); (Carnovalini et al., 2025), machine learning (Elbasi et al., 2025), or a listing of the applications of AI-driven e-Learning systems (Shin et al., 2024), leaving out other important aspects such as the inclusive types of AI tools and their educational benefits. On this backdrop, this paper presents the findings of an SLR that examines the constraints of e-Learning systems, as well as the types, applications, and benefits of integrating AI-driven techniques to ensure that eLearning systems provide personalized learning. Adaptive learning, intelligent tutoring, gamification, virtual assistant, automated evaluation, and personalized suggestions are all examples of personalized learning components (Elbasi et al., 2025). This study answers the following research questions:

1. How does the implementation of AI techniques in e-Learning systems result in personalized learning?
2. What are the limitations of the traditional e-Learning systems?
3. Which AI-driven techniques enhance personalized learning in e-Learning systems?
4. How is AI applied to achieve personalized learning?

The following search string was used to find relevant journal articles for this study: (('enhancing' OR 'leveraging') AND ('personalized' OR 'individualized') AND ('E-learning' OR 'Digital Learning') AND ('Artificial Intelligence' OR 'AI' OR 'Machine Learning') AND ('Higher Learning' OR 'University Education')).

METHODOLOGY

Table 2.1 shows the research protocol used in this work, with source databases Google Scholar, Springer Nature Link and IEEE spanning the years 2020 to 2026. This SLR only accepts journal papers written in English. This survey excluded periodicals, books, SLR, and journal articles written in languages other than English.

Table2.1. Research Protocol

Protocol Element	Research Item
Digital library	Google Scholar, Springer Nature Link and IEEE
Time Interval	2021 - 2026
Abstract	Journal articles written in English
Inclusion Criteria	Times New Roman
Exclusion criteria	magazine, conference papers, books, systematic reviews, articles not in English and out of time frame

The article search began with 1341 publications drawn from IEEE, Springer Nature link and Google Scholar. The initial step of scanning the abstracts removed 1161 records that did not directly explore the issues of e-Learning platforms or present any AI-driven ideas for overcoming the deficiencies of e-Learning platforms, leaving only 180 relevant publications. A full-text review of these 180 publications excluded 148 irrelevant articles that presented no findings related to the goal of this study, leaving only 32 relevant studies. The SLR results are discussed in the Results section.

RESULTS AND DISCUSSIONS

An examination of the journal articles included in this SLR revealed both the challenges of the existing e-Learning systems and the AI technologies that can enhance personalized learning.

Limitations of Conventional E-Learning Systems

Table 3.1 identified several challenges, including a lack of resources to support e-Learning, compromised data privacy and ethical concerns, over-reliance on e-Learning systems, isolation due to limited collaboration with

other learners, system complexity, inability to personalize learning, and system bias.

Table3.1. Challenges of the Existing e-Learning Systems

Source	Challenges with e-Learning Platforms
(Yusoff et al.2025; Singh et al., 2025; Hamad et al., 2024; Vinoth. Et al., 2025; Sebihi et al., 2025; Hamad et al., 2024; Dube, et al., 2026)	Data privacy and ethical concerns
(Eugenia et al.2022; Singh et al., 2025; Vinoth S. et al., 2025; Sevilla et al., 2025; Khan et al., 2025; Yusoff et al.2025; Balalle 2025; Sebihi et al., 2025)	Lack of resources
(Javier Fombona 2020; Laurie Hughes. 2025; Vinoth. Et al., 2025; Liu & Zhu, 2025)	Dependency syndrome
(Bahroun et al., 2023; Bidry et al., 2024.; Mohammadi et al. 2025; Shen et al., 2025; Hwee et al.2024; Wang & Yue, 2024), (Hamad et al., 2024; Singh et al., 2025; Li & Yao, 2023)	Social exclusion
(LI & Yin 2025; Zhou et al., 2025; Dhananjaya et al., 2024; Adnan et al., 2022; Singh et al., 2025; Shen et al., 2025; Villegas-Ch et al., 2024) , (Hamad et al., 2024; Bousalem et al., 2025; Aman et al. 2025; Liu & Zhu, 2025; Liu, 2024; Iqbal et al. 2025),	Complexity
(Saleem & Aslam, 2025; Oh, Lee et al., 2026; Shen et al., 2025; Vinoth. et al., 2025; Sevilla et al., 2025; Santhosh et al., 2024; Sebihi et al., 2025; Hwee et al.2024; Murtaza et al. 2025; Hachaichi et al., 2025; Wang & Yue, 2024)	Limited personalized learning
(Singh et al., 2025; Sevilla et al., 2025; Khan et al.2025; Liu & Zhu, 2025; Xu, 2025; Babu, Yuvansankar & Tharuneshwaran, 2025)	Algorithmic bias

Figure 3.1 depicts the distribution of the challenges identified in the articles included in the SLR for this study. Popular in the literature are concerns about the complexity of using conventional e-Learning systems (23%), followed by a lack of personalized learning (20%), social exclusion (16%), a lack of resources, such as e-Learning system infrastructure (14%), data privacy and ethical concerns (11%), and algorithmic bias (9%) and dependency syndrome (7%) respectively.

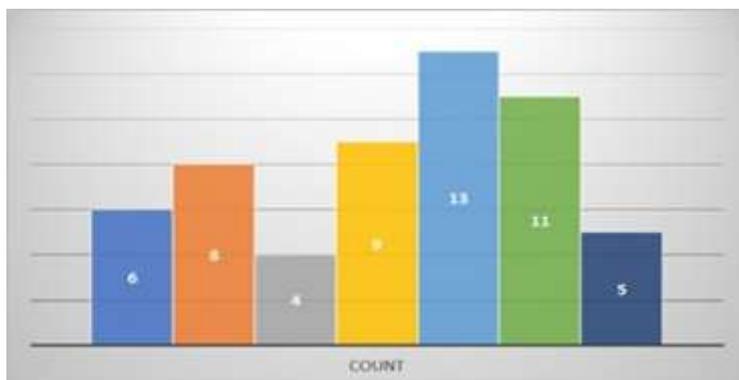


Figure 3.1 Limitations of Conventional e-Learning Systems

Table 3.2 presents the different categories of AI that have been used to enhance personalized learning in the e-Learning systems. These technologies include machine learning, deep learning, generative AI, and natural

language processing. These findings confirm concerns in earlier literature, particularly regarding resources (Dube & Scott, 2016).

Types of AI Technologies

Identified in the literature included in this SLR are the AI technologies for enhancing personalized learning in ordinary e-Learning systems. These AI technologies are illustrated in Table 3.2

Table 3.2 AI Technologies

Source	Technologies	Example
(Hachaichi et al., 2025; Vinoth. et al., 2025; Xu, 2025; Hwee et al.2024; Aman et al. 2025; Benkhalfallah et al., 2024; Naseer, 2024)	ML	Decision trees, SVM, PCA, Gradient Boosting, Clustering, Bayesian networks
(Shin et al., 2024; Liu & Zhu, 2025; Singh et al., 2025; Liu & Zhu, 2025; Bousalem et al., 2025; Iqbal et al. 2025; Laurie Hughes. 2025; Aman et al. 2025; Aman et al. 2025; Oh et al., 2026; Zhou et al., 2025)	DL	Reinforcement learning, Transformer models, Multimodal AI (LAM) and large language models
(Zhou et al., 2025; Liu, 2024; Bahroun et al., 2023; Bidry et al., 2024; Vinoth S. et al., 2025; Santhosh et al., 2024; He, 2025; Hamad et al., 2024; Aman et al. 2025)	Generative AI	ChatGPT
(Vinoth et al., 2025; Murtaza et al., 2025; Patchipulusu, et al., 2023; Sajja, 2024; Tarik, Zakaria & Souhaib)	Natural Language Processing (NLP)	AI writing assistants – Grammarly, Copilot, and AI-supported plagiarism detection – Turnitin

Figure 3.2 depicts the main categories of AI that are capable of enhancing personalized e-Learning. These are categorized into machine learning (19%), deep learning (41%), generative AI (33%), and natural language processing (7%). These findings are confirmed by the literature, which shows that ML is transforming education (Gligorea et al., 2023; Babu, Yuvansankar & Tharuneshwaran, 2025; Lazarenko & Hapchuk, 2024).

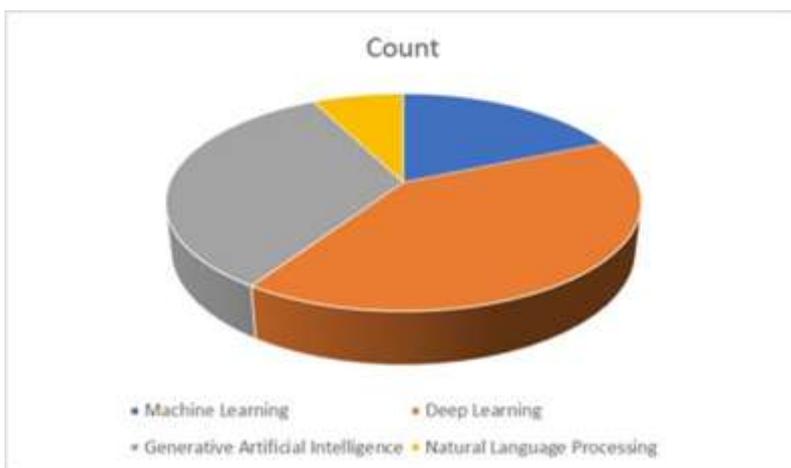


Figure 3.2 AI Technologies used in e-Learning Systems

Applications of AI Technologies in Learning

Table 3.3 summarizes the numerous applications of AI technology in the learning arena. AI technology uses identified in the literature included real-time feedback, assessment, collaboration, tutoring, evaluation and grading, note-taking, performance prediction, writing, and research (Merino-Campos, 2025). Feedback is the

most popular application, with eight references, while note-taking and performance prediction are the least mentioned.

Table 3.3 AI Technology Applications

Source	AI Application
(Zhou et al., 2025; Singh et al., 2025; Sevilla et al., 2025; Liu & Zhu, 2025; Xu, 2025; Khan et al., 2025; Sebihi et al., 2025; Lee et al., 2026)	Real-time feedback
(Zhou et al., 2025; Bahroun et al., 2023; Villegas et al., 2024; Gligorea, et al., 2023; Halkiopoulou, & Gkintoni, 2024; Brada & Dahmani, 2024feedback)	Adaptive assessment
(Vinoth S. et al., 2025; Liu & Zhu, 2025; Hamad et al., 2024)	Collaboration
(Khan et al., 2025; Sevilla et al., 2025; Singh et al., 2025; Zhou et al., 2025)	Tutoring
(Liu & Zhu, 2025; Lee et al., 2026)	Evaluation and grading
(Zhou et al., 2025)	Note tacking
(Zhang et al., 2025)	Performance prediction
(Santhosh et al., 2024; Vinoth S. et al., 2025)	Writing
(Vinoth S. et al., 2025; Sebihi et al., 2025)	Research

Benefits of AI-Driven e-Learning

Existing literature acknowledges that there are several benefits of integrating AI in e-Learning systems (Kaswan, Dhatteval & Ojha, 2024). This section discusses the benefits of enhancing personalized e-Learning through AI technologies. Table 3.4 demonstrates the popular benefits found in existing literature. These findings are supported by existing literature; for example, Halkiopoulou & Gkintoni (2024) confirm that implementing AI in e-Learning systems promotes personalized learning and adaptive learning.

Table 3.4 AI Benefits in Learning

Sources	AI Benefit
Zhou et al., 2025; Singh et al., 2025; Sevilla et al., 2025; Liu & Zhu, 2025; Xu, 2025; Khan et al., 2025; Bhatia., Bhatia, & Sood. 2024; Khalleefah, 2025)	Student engagement
(Zhou et al., 2025; Khan et al., 2025)	Task management
(Singh et al., 2025; Sebihi et al., 2025; Khalleefah, 2025; Murtaza, et al., 2022)	Personalized learning experiences
(Singh et al., 2025)	Task automation
(Singh et al., 2025)	Learning material accessibility
(Liu & Zhu, 2025)	Improved creativity
(Wang & Yue, 2024; Hamad et al., 2024)	Explainability
(Dhananjaya et al., 2024; Vinoth S. et al., 2025)	Better understanding



CONCLUSION

The study aimed to report the results of SLR on both the problems of e-Learning systems and AI technologies capable of resulting in personalized learning in e-Learning systems. Although artificial intelligence technologies such as machine learning and natural language processing have shown significant promise in a variety of sectors, there is currently a dearth of research and fragmentation regarding their systematic integration into individualized e-learning systems for higher education. The creation of comprehensive AI-powered frameworks capable of successfully customizing learning experiences while maintaining educational quality. Augmented reality technology can also be implemented to work hand-in-hand with personalized E-learning systems to provide students with a virtual learning environment for greater understanding.

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