A REVIEW ON PREDICTIVE FACTORS OF ACADEMIC PERFORMANCE IN ONLINE LEARNING ENVIRONMENT

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Abstract:

Higher education institutions deeply integrate online learning platforms into their curricula. Learning management systems (LMS) are a core component of online learning in higher education, facilitating instruction, communication, and assessment. However, students vary significantly in their online learning effectiveness, triggering a significant amount of research on the factors that influence the predictors of academic performance. This paper provides a comprehensive review of predictors of student achievement in online learning by systematically searching and screening the literature between 2021 and 2024 in multiple academic databases, resulting in the inclusion of 27 high-quality studies. It was found that the existing literature focuses on three main areas: behavioural prediction, psychological prediction and technological prediction. However, although each of these factors is considered to be closely related to student performance, current research tends to explore them from an isolated perspective, ignoring the dynamic chain of linkages between technology, psychology, behaviour and performance. Therefore, future research should build an integrated model to explore how the characteristics of LMS platforms affect students' psychological state and behaviours, and ultimately affect learning outcomes, so as to provide theoretical support and practical guidance for improving the quality of online education.

Keywords:

Online Learning, Academic Performance, Learning management systems, Behavioural Prediction, Psychological Prediction, Technological Prediction

Introduction

In today's educational landscape, information technology has become a powerful driving force, profoundly transforming traditional teaching structures and operational models (Wark, 2018). The integration of technology not only allows students to access a wealth of educational resources anytime and anywhere but also effectively bridges the gap between on-campus education and remote learning (Jukes & Schaaf, 2019). In particular, the outbreak of COVID-19 in 2020 significantly accelerated the rapid development and widespread adoption of online learning. According to the 47th Statistical Report on Internet Development in China , as of December 2020, the scale of online education users in China reached 342 million (China Internet Network Information Centre, 2021). Higher education institutions are deeply integrating online learning platforms into their curricula. In this irreversible trend, the stability and enhanceability of Academic performance, a key indicator for measuring students' learning effectiveness, assessing the quality of education, and predicting future development, faces unique challenges posed by the online environment (Sorour et al., 2015). The relative isolation of learners, differences in technology acceptance, and weakened classroom interactions make the mechanisms influencing online academic achievement more complex and diverse than in traditional learning environments.

Learning Management Systems (LMS) are a core component of online learning environments, facilitating instruction, communication, and assessment. While LMS platforms are widely adopted, student performance in these environments remains highly variable.Among the numerous online learning projects launched, only 15% have achieved success and met their intended goals, while 40% have faced partial setbacks (Al-araibi et al., 2019). Some university students resist adopting LMS, preferring traditional face-to-face interactions instead (Abdel-Jaber, 2017). The technical and functional aspects of systems not only determine students' willingness to use the platform but also directly affect their learning efficiency and outcomes (Shah & Attiq, 2016). The investment in technology is not proportional to the acquisition of performance.

Against this backdrop, identifying and clarifying the key predictors of academic performance in online learning holds profound theoretical value and pressing practical significance. On one hand, educational institutions urgently need evidence-based insights to optimize the design of Learning Management Systems (LMS) and instructional strategies; on the other hand, teachers require targeted interventions to support student success, while learners themselves seek scientifically grounded pathways to improve online learning outcomes. Although existing studies have examined various influencing factors of online learning, such as technology acceptance, interaction quality, instructional design, and individual characteristics (Ait Daoud et al., 2024; Saputra et al., 2023), significant limitations remain in this field. The research perspectives are highly fragmented, with most studies focusing on a single category of variables (e.g., solely on technological or psychological factors), lacking a systematic integration of multidimensional predictors across technology, behavior, psychology, and pedagogy. In particular, there has been insufficient exploration of the dynamic interaction mechanisms among key variables, such as mediation and moderation effects. How exactly do high-quality LMS platforms influence academic performance through psychological mechanisms? How do these psychological processes regulate the depth and continuity of LMS usage? These complex "webs of relationships" are central to understanding the logic behind online learning outcomes but have yet to be thoroughly unpacked. Therefore, this review aims to address this critical research gap by synthesizing and categorizing key variables affecting

online academic performance based on an analysis of empirical studies from the past four years, both domestically and internationally.

Literature Review

As the core platform for online learning, Learning Management Systems (LMS) have a direct impact on the depth of technology adoption and learning effectiveness through their functionality, reliability, and user experience. LMS is a comprehensive platform that integrates course management, learning resource distribution, online assignments, performance evaluation, and teacher-student interaction, effectively supporting blended learning models that combine online and offline instruction (Bradley, 2021). Through LMS, higher education institutions can standardize course content management, visualize teaching processes, and analyze student learning data with precision, helping educators refine their instructional design and enhance teaching outcomes. Popular LMS platforms include Moodle, Blackboard, and Canvas. These systems not only provide traditional course management features but also incorporate advanced functions such as mobile learning, online quizzes, automated grading, and learning progress tracking, significantly expanding teaching and learning possibilities (Bradley, 2021).

As online learning becomes increasingly entrenched in educational practice, understanding the relationship between LMS quality and student performance has become a key area of research. First, system quality issues mainly manifest in platform stability, response speed, and user interface design. Some LMS platforms have complex interfaces, inconvenient operations, frequent system crashes, or slow response times—technical issues that negatively impact students' learning experiences and motivation (Aldholay et al., 2020; Butt et al., 2021). Second, information quality is a crucial indicator for assessing the effectiveness of LMS, as it relates to the accuracy, comprehensiveness, and update frequency of course content. On some platforms, outdated content, limited resources, or fragmented information fail to meet students' diverse learning needs (Aldholay et al., 2020; Butt et al., 2021). Additionally, service quality is another critical factor, encompassing the timeliness of technical support, the effectiveness of teachers' online guidance, and the learning support services provided by the platform. Many students report difficulties in obtaining timely and effective assistance when facing technical issues or academic challenges, leading to decreased learning efficiency.

Educators and researchers have increasingly focused on the quality of Learning Management Systems (LMS), aiming to leverage information technology to improve teaching effectiveness. However, a large body of empirical research has shown that students' academic performance in LMS-based environments exhibits significant heterogeneity. Some learners face challenges such as low engagement, poor completion rates, and declining academic outcomes. This phenomenon has prompted continued scholarly exploration into the predictors of online learning effectiveness, with the aim of identifying key influencing variables to provide a scientific basis for instructional interventions and personalized learning support.

Theoretical Foundations

In order to exploring academic performance in online envrionment, this article draws upon the Technology Acceptance Model (TAM), the Delone and McLean IS Success Model, and Flow Theory. These theories offer insights into the various dimensions and factors that contribute to student performance and have been widely used and tested in empirical research.

Technology Acceptance Model

The Technology Acceptance Model (TAM) was originally introduced by Davis (1989) to study the mechanisms by which users as individuals influence the use of systems and technologie .TAM explains the behaviours of users in terms of how they adopt and use a technology, and is an important tool for information technology research (Davis, 1989). According to figure 1, user attitudes toward use are determined by two variables, perceived use and perceived ease of use, and that external variables, such as platform quality, social influence, self-efficacy, can affect perceived use and perceived ease of use (Malureanu et al., 2021; Prastiawan et al., 2021). TAM serves as a prominent framework for comprehending the factors that influence individuals' inclination to accept or reject technology (Granić & Marangunić, 2019).Previous studies have found that the Technology Acceptance Model effectively predicts the intention and adoption of information technology and systems.
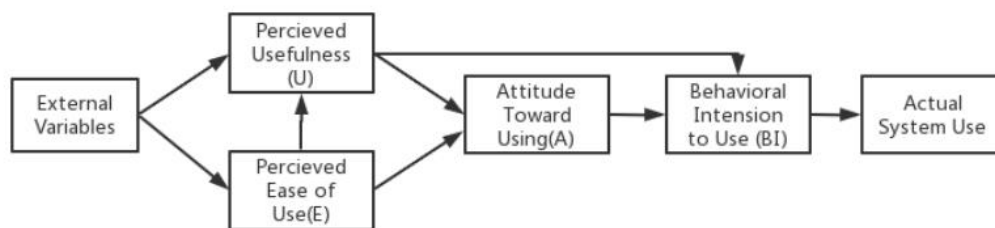

Figure 1: Technology Acceptance Model (Davis,1989)

DeLone and McLean (D&M) IS Success Model

DeLone and McLean first proposed the Information Systems Success Model in 1992, which is one of the most well-known models in the study of information system success. It provides a strong theoretical framework for measuring the performance of information systems (DeLone & McLean, 1992). In 2003, after continuous analysis and research, DeLone and McLean refined the model based on relevant studies and practical applications. They argued that changes in the role of information systems made it necessary to include service quality as a separate variable. As a result, they incorporated service quality into the model (DeLone & McLean, 2003). The revised Model defines information system quality across three key dimensions: system quality, information quality, and service quality（Figure 2). System quality, information quality, and service quality are not only essential components of the learning system but also serve as key indicators for evaluating the effectiveness of an information system (IS).
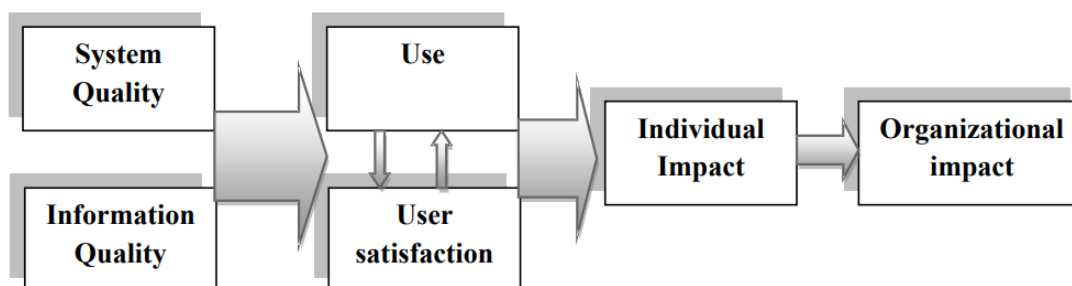

Figure.2: Delone & McLean IS Success Model (2023)

Flow Experience

Flow describes a state in which an individual becomes fully immersed in an activity, experiencing a heightened sense of concentration and control, ultimately reaching an optimal state of engagement. Csikszentmihályi defines it as a unique psychological state in which individuals exhibit such intense focus on a task that they lose track of time and self-awareness, making the activity itself an intrinsically rewarding experience (Czikszentmihalyi, 1990). Flow is not limited to traditional learning environments; it is equally applicable to online learning contexts. In such settings, flow can trigger a range of positive emotional responses, significantly enhancing learners' performance and fostering continuous engagement in learning activities, ultimately leading to the development of long-term learning habits (Kaya & Ercag, 2023).

Current research often remains isolated within the domains of technology, psychology, or behavior, overlooking their complex interrelationships. This review critically examines the key predictors of academic performance in online learning and, by integrating the Technology Acceptance Model, the Information Success Model, and Flow Theory, highlights the urgent need to investigate the dynamic chain linking technology, psychology, and student behavior.

Method

In order to understand the impact of learning management systems on students' academic performance, this study conducted a comprehensive review of relevant empirical studies. The literature search was conducted using three major academic databases: Scopus, Web of Science Core Collection and ScienceDirect. The search focused on peer-reviewed English language journal articles published between 1 January 2021 and 1 December 2024 Search terms included 'learning management system' 'LMS' 'online learning platform', 'learning performance', 'academic achievement' and other combinations of keywords. In addition, forward and reverse citation tracking was performed on the identified articles to ensure comprehensive coverage of relevant literature. Included studies had to (1) specifically focus on the effects of LMS in an online educational setting; (2) be empirical studies that explicitly described the methodology and results; (3) include quantitative data on learning outcomes or implementation effects; and (4) be published in peer-reviewed English-language journals. We analysed topics, focusing on empirical studies investigating the relationship between LMS characteristics, user perceptions, user behaviors and learning outcomes, excluding conference papers, book chapters, and theoretical papers without empirical data. After applying inclusion/exclusion criteria and removing duplicates, 27 papers were obtained (Appendix). The screening process is shown in Figure 3 below.
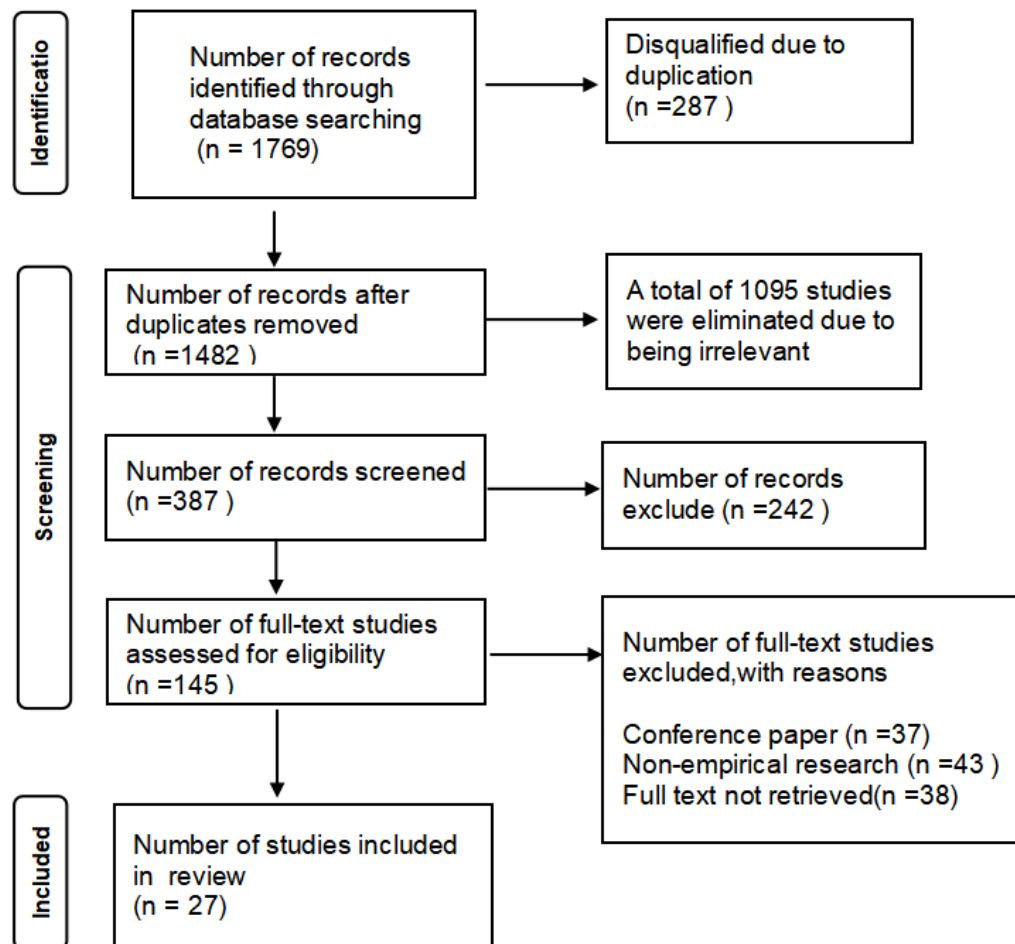
Figure 3: Study Identification and Selection Process Flowchart

Results and Discussion

Measurement and Influencing Factors of Academic Performance

Academic performance is usually defined as the extent to which a student meets the academic standards set by his/her educational institution (Asiah et al., 2019). In the existing literature, academic performance is mostly measured through various types of indicators such as final course grades, grade point average (GPA), test scores, and assignment completion rates (Eakman et al., 2019). In addition, some studies have taken self-reported learning outcomes into account, such as perceived learning gains and learning satisfaction. Despite differences in the evaluation criteria used across disciplines and schools, quantitative standardised measures continue to dominate.

Addressing the key issues of academic achievement in online learning contexts, researchers have conducted an in-depth exploration aimed at identifying the main factors that influence achievement (Alabdulkarem et al., 2021). These factors can be categorised into two main groups: cognitive and non-cognitive. In terms of non-cognitive factors, it has been noted that the characteristics of the learning platform, students' personality traits, and self-regulated

learning strategies all have an impact on performance (Arias et al., 2021). Although non-cognitive factors play an important role in learning effectiveness, cognitive factors, such as problem-solving skills, self-efficacy, and overall learning experience, should not be overlooked as well, and have also been shown to be strongly associated with academic achievement (Widyaningrum et al., 2024). Multiple factors intertwine to influence student performance, which has prompted higher education institutions to adopt diverse strategies to promote academic achievement.

Behavior Predictors: Duration and Frequency

Numerous researchers have explored the relationship between online learning behaviour and academic performance, and have used online learning behaviour to predict academic performance. students' level of activity and frequency of use are generally recognised as being associated with better academic performance (Ellis et al., 2017). Cenka et al. (2022) state that students who are more active usually achieve better grades than those who are inactive in the learning management system (Cenka et al., 2022). It has been found that if students are not logged into the LMS, they tend not to view or submit assignments, engage in discussion board interactions, or complete other activities that contribute to the achievement of learning goals (Sunyoung & Jihoon, 2024). Researchers explored the impact of student interaction with university resources by monitoring the effects of these interactions on achievement. They calculated the number of course file downloads and course viewing time, and found that students who interacted less made less academic progress (Isikgöz, 2024). Also, they noted that the higher the number of non-participation alerts received, the lower the students' academic progress(Qazdar et al., 2023).

Sharma et al. (2020) also highlighted the impact of time spent on the LMS and frequency of use on students' final grades and showed that these two variables had a significant effect on final grades. Hamidullah et al. (2020) further analysed students' behavioural activities on the LMS and found that there was a direct correlation between the time spent logging in and the frequency of logging in and the final grades. Nieuwoudt's (2020) study came to a similar conclusion that the length of time students invested in the LMS significantly predicted their final grades.Meanwhile, Darko (2021) explored the relationship between the amount of time students spent on the LMS and their final exam grades through a qualitative study spanning four academic years (Darko, 2021). The study found that the more time students invested in the LMS, the better their grades were, while Bai et al. (2022) encouraged students to participate online by designing gamification-based learning tasks and observed that a high level of peer interaction not only increased engagement, but also improved academic performance (Bai et al., 2022). Such tasks help to motivate students in the online learning environment. This series of studies reveals behavior factors that promote online engagement, aiming to optimise students' academic outcomes by enhancing the learning process.

Psychological Predictors: Motivation and Self-Efficacy

The psychological dimension has gained increasing attention in understanding online learning success. Motivation and self-efficacy, in particular, are frequently cited as strong predictors of performance (Hanham et al., 2021; Malureanu et al., 2021; Widyaningrum et al., 2024). Intrinsically motivated learners are more likely to persist, actively engage, and make better use of LMS tools. Similarly, students with high self-efficacy believe in their ability to succeed, leading to higher academic resilience. Despite these insights, the psychological domain is often disconnected from the technological environment in which learning occurs, missing how platform design affects learners' mental states.

Some researchers believe that learning management systems (LMS) foster the chances of individualized instruction as well as collaborative learning, which can enhance the learning outcomes of students (Furqon et al., 2023). Further, the gamification and interactive multimedia components could be adopted in LMS to boost motivation and engagement (Jayalath & Esichaikul, 2022). Kaya & Ercag conducted an experiment and found that the application of gamified learning methods based on challenges improved learning achievement levels and overall motivation. Among the sub-factors of motivation, the experimental group's confidence level and satisfaction with the course were significantly higher than those of the control group (Kaya & Ercag, 2023).

Technological Predictors: LMS Features and Usability

The integration of Learning Management Systems (LMS) into online education has significantly transformed the teaching and learning landscape. Researchers assert that LMS platforms play a pivotal role in facilitating both individualized instruction and collaborative learning, thereby contributing positively to students' academic performance and overall learning outcomes (Furqon et al., 2023). LMSs allow instructors to tailor content based on learners' needs and progress, offering personalized pathways that support differentiated instruction. At the same time, they provide collaborative tools such as discussion forums, group assignments, and peer feedback mechanisms that promote interaction and knowledge sharing among students, fostering a more engaging and inclusive learning environment. In addition to content delivery and communication tools, the incorporation of gamification elements and interactive multimedia features within LMS platforms has gained attention as a strategy to enhance learner engagement and motivation. Features such as quizzes, badges, leaderboards, animations, and simulations can make learning experiences more dynamic and enjoyable, ultimately encouraging sustained participation and improved knowledge retention (Jayalath & Esichaikul, 2022).

Research focusing on the LMS itself explores how LMS features impacts user satisfaction and engagement (Aldiab et al., 2019; Alserhan & Yahaya, 2021; Benbaba & Lindner, 2021; Putro et al., 2021). Usability, in particular, is frequently cited as a critical determinant of students' willingness to adopt and consistently use LMS platforms. Studies have shown that when LMS interfaces are intuitive, user-friendly, and reliable, users tend to have a more positive experience, which leads to higher satisfaction levels and increased usage rates(Prabowo, Ikhsan, et al., 2022). Factors contributing to LMS usability include system reliability, ease of navigation, clarity of instructions, aesthetic appeal, and responsiveness across different devices.

Moreover, system quality—encompassing attributes such as functionality, availability, technical support, and performance efficiency—has also been recognized as a fundamental component influencing successful LMS adoption and user satisfaction (Butt et al., 2021). When systems are stable, consistently accessible, and meet user expectations in terms of speed and functionality, students and educators are more likely to integrate them into their teaching and learning routines. Information systems research further supports the notion that consistent and meaningful use of technology leads to better performance outcomes(Prabowo, Yuniarty, et al., 2022) .Thus, for an LMS to effectively support online learning, both its usability and system quality must align with the users' pedagogical and technological needs.

Nevertheless, most of these studies stop short of linking system features directly to academic performance through mediating psychological or behavioral mechanisms.

The Neglected Dimension: Flow Experience and Behavioral Engagement

The missing link in current research lies in the transitional process from LMS usage to learning outcomes. Learning management systems (LMS) provide essential functionalities such as course management, resource distribution, assignment submission, and grade tracking. The usability and stability of these features directly affect students' learning experiences (Swerzenski, 2021). Research indicates that user-friendly and intuitive platforms significantly enhance students' usage frequency and learning efficiency (Widyaningrum et al., 2024).Beyond delivering structured course content, LMS platforms support communication between students and instructors, enabling a more personalized and flexible learning experience. Online discussion forums, in particular, facilitate efficient interaction, allowing instructors to respond promptly to students' questions and academic needs, thus enhancing the quality of instructional support.

A key yet often overlooked factor in the technology adoption-performance chain is the flow experience—a state of deep focus, immersion, and enjoyment during learning activities. The course design of an online learning platform enhances the mind-flow experience by adding a balance of challenging skills and playability to improve learning performance (Yen & Lin, 2022).However, various technical and design-related barriers can interrupt this experience. Issues such as system lags, disorganized interfaces, cluttered layouts, and poor mobile optimization can disrupt user concentration and reduce motivation (Alkhawaja et al., 2022). In contrast, intuitive interfaces, responsive systems, and cross-device compatibility help sustain user engagement and facilitate positive learning outcomes. Flow experience also mediates the relationship between individual perception and academic behavior. For instance, students who perceive the system as beneficial to their learning are more likely to enter a state of flow and demonstrate deeper cognitive engagement(Adeyeye et al., 2022). As such, LMS quality indirectly shapes academic performance through its influence on student psychology and behavior.

Conclusion

In summary, academic achievement, as a core indicator of learning effectiveness, has consistently been a central focus in online learning research within the higher education system (Prabowo, Ikhsan, et al., 2022). Existing literature provides ample evidence of a significant relationship between the use of Learning Management Systems (LMS) and student performance (Butt et al., 2021; Kaya & Ercag, 2023). According to a growing research consensus, a high-quality LMS should possess technical reliability (e.g., responsiveness, stability, and functional completeness, which form the foundation for sustained use), user-oriented design (e.g., intuitive interface, user-friendly navigation, and support for personalized learning paths to reduce cognitive load and enhance focus), and support for immersive experiences (e.g., facilitating "flow" experience) (Butt et al., 2021; Kaya & Ercag, 2023). Such immersive experiences not only enhance learning motivation but also promote deep learning.

Furthermore, the frequency and duration of LMS usage have been shown to affect learning outcomes, indicating that a high-quality system can not only attract continuous student engagement but also effectively promote knowledge internalization and skill development during use. Importantly, research has revealed that these key factors—system quality, usage behavior, and psychological states—do not operate in isolation but rather form a dynamic and

interactive network. Learners' internal psychological states (e.g., motivation, self-efficacy, and "flow" experience) are likely to play a central mediating role in explaining the mechanism by which LMS usage ultimately translates into improved academic performance (Kaya & Ercag, 2023). Uncovering this complex, dynamic interaction and mediation mechanism is a core direction for future research.

Systematically identifying and understanding the key predictors of academic performance in online learning holds significant theoretical value and urgent practical implications. This review not only reaffirms the role of high-quality LMSs as critical infrastructure for enhancing academic achievement but also delves deeper into the complex interplay of multidimensional factors underlying learning effectiveness. The behavioral characteristics of LMS usage (e.g., continuity, frequency, depth), learners' internal psychological states (e.g., flow experience, learning motivation, self-efficacy), and perceived system quality are all indispensable core variables.

Contribution and Implications

The findings of this review suggest that the transition from LMS quality to academic performance does not occur directly, but rather relies on key mediating mechanisms such as flow experience, self-efficacy, and actual usage. This offers a holistic perspective for the design and implementation of educational technologies. Furthermore, higher education institutions and frontline educators should move beyond viewing LMS as merely a technical tool and instead place strong emphasis on students' psychological needs and subjective experiences.

This review also provides clear implications for educational practitioners. When applying LMS and designing instruction, educators should strengthen motivational support by designing learning tasks that are more engaging and meaningful. They should leverage the interactivity and real-time feedback of LMS to stimulate intrinsic motivation. By carefully aligning task difficulty with learners' skill levels and utilizing the immersive potential of LMS (such as gamification elements and simulated environments), educators can foster a state of focused engagement. Only by translating research findings into concrete teaching practices and system optimization strategies can higher education more effectively empower students, helping them overcome challenges and achieve greater academic success throughout their educational journey.

Limitation and Future Suggestion

This study aims to reveal the dynamic interplay among technological, psychological, and behavioral dimensions and their impact on academic performance in online learning. However, it is important to acknowledge the limitations of this research. The study focuses on a specific technological platform (LMS) and learning environment, and its findings may not be directly generalizable to contexts involving different technological tools, such as adaptive learning systems or social learning platforms.

Looking ahead, future research should explore a broader range of technological tools and further analyze the complex mechanisms among predictive variables. For example: How does high motivation lead to deeper and more sustained LMS use, thereby enhancing flow experience and ultimately improving academic outcomes? What specific mediating or moderating role does self-efficacy play in the chain linking LMS usage to academic performance? Are there differences in sensitivity to these variables among different student groups (e.g., freshmen vs. upperclassmen, students from different disciplinary backgrounds)?

Moreover, future studies should adopt a more practice-oriented approach by investigating how to optimize LMS design, functionality, and interactive experience (e.g., personalized recommendations, enhanced interactivity, timely feedback, and appropriately challenging tasks to foster flow experience). Research should also examine how adjustments in teaching strategies and course design (e.g., aligning LMS activities with course objectives, designing tasks that stimulate motivation, and fostering metacognitive and self-regulatory skills) can be leveraged to more effectively utilize these key identified variables and maximize their positive impact on academic performance.

Appendix: Empirical Studies on Predictors of Academic Performance in Online Learning

No.	Author and Year	Title	Journal
1	(Hernández-García et al., 2024)	Exploring the relationship between LMS interactions and academic performance: A Learning Cycle approach	Computers in Human Behavior
2	(Bećirović, 2024)	Examining learning management system success: a multiperspective framework	Education and Information Technologies
3	(Isikgöz, 2024)	Do Learning Management System Activities in Online Pedagogical Education Significantly Predict Academic Performance?	Turkish Online Journal of Educational Technology
4	(Nácher et al., 2021)	The effectiveness of the GoKoan e-learning platform in improving university students' academic performance	Studies in Educational Evaluation
5	(Semlambo et al., 2022)	Factors Affecting the Adoption of E-Learning Systems in Public Higher Learning Institutions in Tanzania: A Case of Institute of Accountancy Arusha	Journal of Computer and Communications
6	(Sunyoung & Jihoon, 2024)	A Study on the Effectiveness of LMS for Improving College Student's Mathematics Performance using a Propensity Score Matching Method	Educational Technology International

7	(Bessadok et al., 2023)	Exploring students digital activities and performances through their activities logged in learning management system using educational data mining approach	Interactive Technology and Smart Education
8	(Nguyen, 2024)	LMS-based integrated online assessment implementation at the university to foster learning motivation and academic performance	Interactive Learning Environments
9	(Widyaningrum et al., 2024)	The Role of System Quality and Self-Efficacy in E-Learning Users: Exploring the Determinants of Academic Achievement	Jurnal Pedagogi dan Pembelajaran
10	(De La Puente et al., 2024)	Impacts of Online Learning Tools on Math Performance: Initial Insights from a Quasi-Experimental Study in Colombian High Schools	Ubiquitous Learning
11	(Alsubaie, 2023)	Predicting student performance using machine learning to enhance the quality assurance of online training via Maharat platform.	Alexandria Engineering Journal
12	(Al-Sulami et al., 2023)	Predicting at-risk students' performance based on LMS activity using deep learning.	International Journal of Advanced Computer Science and Applications
13	(Qazdar et al., 2023)	Newly Proposed Student Performance Indicators Based on Learning Analytics for Continuous Monitoring in Learning Management Systems.	International Journal of Online & Biomedical Engineering
14	(Ait Daoud et al., 2024)	FSLSM-Based Analysis of Student Performance Information in a Blended Learning Course Using Moodle LMS.	Open Information Science,

15	(Yen & Lin, 2022)	Investigating the effect of flow experience on learning performance and entrepreneurial self-efficacy in a business simulation systems context	Interactive Learning Environments
16	(Suad et al., 2023)	The Impact of Moodle Learning Analytics on Students' Performance and Motivation.	International Journal of Instruction,
17	(Saputra et al., 2023)	Do system quality and information quality affect job performance? The mediation role of users' perceptions	Plos one
18	(Mamedova et al., 2023)	Online education of engineering students: Educational platforms and their influence on the level of academic performance	. Education and information technologies
19	(Kaya & Ercag, 2023)	The impact of applying challenge-based gamification program on students' learning outcomes: Academic achievement, motivation and flow	Education and Information Technologies
20	(Avcı & Ergün, 2022)	Online students' LMS activities and their effect on engagement, information literacy and academic performance.	Interactive Learning Environments
21	(Prabowo, Ikhsan, et al., 2022)	Student performance in online learning higher education: A preliminary research.	Frontiers in Education

22	(Prabowo, Yuniarty, et al., 2022)	Student engagement mechanism of online learning: The effect of service quality on learning management system.	International Journal on Informatics Visualization
23	(Pesovski et al., 2022)	The impact of learning management systems on student achievement and engagement in online classrooms.	EDULEARN22 Proceedings
24	(Adeyeye et al., 2022)	Online learning platforms and covenant university students' academic performance in practical related courses during COVID-19 pandemic.	Sustainability
25	(Butt et al., 2021)	Students' performance in online learning environment: The role of task technology fit and actual usage of system during COVID-19.	Frontiers in psychology
26	(Oguguo et al., 2021)	Effect of learning management system on Student's performance in educational measurement and evaluation.	Education and Information Technologies
27	(Kauts & Kaur, 2021)	Effectiveness of Moodle-LMS on the Academic Achievement and Student Satisfaction among IX grade Mathematics Learners.	Turkish Online Journal of Qualitative Inquiry

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