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A Conceptual Framework for Understanding the Impact of Learning Management Systems on Teaching Quality and School Management: A China–US Comparison

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Abstract. The rapid expansion of digital learning management systems (LMS) has shaped teaching, learning, and school management worldwide, yet their adoption and impact vary across countries. This study develops a conceptual framework to understand how LMS affect teaching quality and school management in different national contexts, using China and the United States as comparative cases. Drawing on socio-technical systems theory and comparative institutional analysis, LMS are conceptualized as educational infrastructures shaped by the interaction of technology, governance, and teacher practice. Rather than testing causal relationships, this study presents a set of theoretically based propositions to explain cross-national differences in LMS adoption patterns, teaching impacts, and management outcomes. It proposes that LMS effectiveness depends on national policy environments, governance models, and teacher professionalism. Centralized education systems tend to emphasize the standardization and governance functions of LMS, while decentralized systems are more likely to leverage LMS to improve administrative efficiency and coordination. By shifting focus to institutional embeddedness, this study contributes to research in comparative education and educational technology and provides theoretical guidance for future empirical studies on digital learning systems.

Keywords: Learning Management System, Digital Learning Platforms, Teaching Quality, School Management, Conceptual Framework

1. Introduction

Over the past decade, the widespread application of learning management systems (LMS) has become a significant feature of educational digitalization. Platforms such as Canvas, Blackboard, and Moodle in the United States, as well as MOOC and national digital learning platforms in China, are increasingly embedded in daily teaching, learning, and school administration by supporting instructional delivery, communication, assessment, and management functions. LMS adoption has moved beyond emergency remote teaching and entered a phase of long-term institutional infrastructure development because of the global promotion of hybrid and online teaching models. Despite their global diffusion, their impact on education varies and is constrained by specific circumstances. Existing research often reports positive correlations between LMS use and indicators

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such as teaching quality, student engagement, and administrative efficiency. However, these effects are not uniformly consistent across different countries. Each country has significant differences in its educational governance structure, policy orientation, digital infrastructure level, and professional norms surrounding the use of technology by teachers. Therefore, the same LMS may yield different results across different institutional environments. Rather than exploring LMS effectiveness in isolation, this paper argues their influence is institutionally embedded and socio-technically shaped. It constructs a conceptual framework explaining cross-national differences in LMS adoption and outcomes, proposing theoretical propositions for future empirical research.

2. Literature review

2.1. LMS as socio-technical infrastructure

LMS have long been viewed as integrated digital platforms that support and optimize teaching and learning. Early studies defined LMS as web-based systems for sharing learning materials, submitting assignments, and online communication [1]. They were later conceptualized as virtual learning environments that extend face-to-face instruction through information and communication technologies [2]. Subsequent research highlighted their multifunctional nature, describing LMS as systems for tracking and managing learning activities and integrating course content with instructional administration tools [3,4]. Across studies, LMS functions generally fall into four domains: content delivery, assessment and feedback, communication, and learning analytics. More recent studies characterize LMS as socio-technical infrastructure within institutions, not just tools. Wu sees them as core to higher education's tech infrastructure via standardized modules [5]. Their design and use are constrained by institutional rules and practices, which shape teaching by embedding regulations into daily work and converting activities into data for monitoring. Consequently, LMS outcomes depend on their technical features and institutional embeddedness.

2.2. LMS and teaching quality

A substantial body of research examines the relationship between LMS usage and teaching quality. Core functions such as assignment submission, discussion forums, quizzes, and feedback tools are widely recognized for supporting formative assessment and enhancing learning outcomes. Empirical studies report positive associations between LMS use and students' cognitive performance, motivation, and satisfaction [6]. By extending interaction beyond classroom hours, LMS enable asynchronous communication and sustained academic dialogue, thereby promoting student engagement [2]. However, scholars caution against overreliance on digital platforms. Excessive dependence on LMS may weaken meaningful teacher-student interaction, constrain pedagogical creativity, and reduce teaching to a tool-driven process [5]. Teacher-related factors play a crucial moderating role in this relationship. Teachers with higher digital literacy and technological self-efficacy are better able to translate LMS functionalities into effective teaching practices that support student autonomy, engagement, and learning quality [7]. Conversely, insufficient training and institutional support may limit LMS use to basic content distribution rather than meaningful teaching transformation.

2.3. LMS, learning analytics, and student outcomes

Advances in learning analytics have further expanded LMS-related research. LMS platforms generate extensive learning data, including login frequency, content access patterns, interaction

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duration, and assessment records. These data are increasingly analyzed using statistical, machine learning, and deep learning approaches to predict student performance and monitor learning trajectories [8]. Most studies suggest that LMS-based analytics can support evidence-based teaching decisions and enhance teaching quality and student learning outcomes. LMS also plays a crucial role in implementing personalized learning paths. By analyzing students' learning behaviors and tracking their learning progress, educators can dynamically adjust teaching content and intervention measures to meet individual needs, thereby achieving effective personalized teaching [7]. These findings indicate that the LMS is not only a platform for delivering knowledge but also significantly supports teaching activities and enhances learning sustainability to reshape the education system.

2.4. LMS and school management

Beyond classroom teaching, LMS adoption significantly impacts school management and administrative efficiency. LMS streamlines workflows by storing user data, reducing paperwork, centralizing student records, and simplifying administration [9]. They also enhance communication among teachers, administrators, and students through a unified platform for notifications, documentation, and reporting. Increasingly, LMS-generated data are embedded in governance and accountability systems, supporting performance monitoring and policy compliance. Research shows that European managers value LMS for centralized communication and community-building, whereas Chinese educators focus more on regulartory compliance and political risk management [5]. The findings suggest LMS implementation is closely interwined with institutional governance structures. Despite expanding scholarship, several gaps remain. First, most studies focus on single-country or single-institution contexts. Second, research emphasizes higher education, with less attention to primary and secondary schooling. Third, teaching quality and school management are often analyzed separately rather than within a unified framework. Most importantly, systematic cross-national comparisons remain limited in addressing theoretical differences across systems.

3. Conceptual framework

3.1. Theoretical foundations

This paper proposes a socio-institutional conceptual framework to explain the impacts of LMS by integrating social institutional theory, socio-technical systems theory, comparative institutionalism, and technology-mediated pedagogy. First, the social institutional perspective offers a functionalist lens, viewing education as a system that maintains social order, transmits knowledge, and coordinates roles [10]. From this view, LMS supports these functions through standardization, coordination, and accountability, embedding routines into digital infrastructures. Cross-country differences in LMS outcomes therefore stem from variations in functional priorities not the technology itself. Second, socio-technical systems theory conceptualizes LMS as infrastructures shaped by technology, institutions, and human agency, emphasizing their role in structuring teaching practices and management processes [11]. Third, comparative institutionalism highlights that organizational outcomes are embedded in governance structures and cultural norms—centralized systems favor standardization, decentralized one's autonomy—explaining cross-national variation in LMS effects. Fourth, research on technology-mediated pedagogy stresses teachers' digital capabilities and beliefs in determining whether LMS drive improvement or merely compliance, a crucial cross-national consideration given differing expectations of autonomy and accountability [12].

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Figure 1 presents the socio-institutional framework, positioning LMS as an institutionally embedded infrastructure. Four foundational theories—Social Institutions (Functionalism), Socio-Technical Systems Theory, Comparative Institutionalism, and Technology-Mediated Pedagogy—inform the mediated "Conditional Pathways" through which LMS affects outcomes. The framework highlights two key outcome domains: teaching quality (practice and engagement) and school management (coordination and administration), shaped by governance structures, policy environments, and professional capacities.

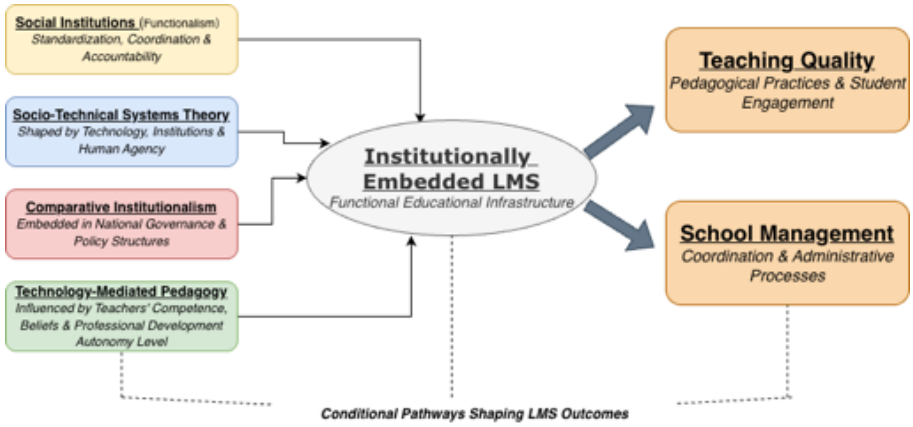

Figure 1. Socio-institutional conceptual framework for LMS impacts

3.2. Three analytical dimensions

This conceptual framework is structured by three dimensions: (1) Technological–LMS functional features and usage, including platform integration, frequency, and scope of teaching and management functions; (2) Institutional–governance structures, policies, and accountability mechanisms shaping LMS goals such as teaching improvement, administrative efficiency, and system monitoring; (3) Agency autonomy–teachers' and leaders' digital competencies, training, and perceived autonomy, which mediate LMS implementation. LMS thus act as intermediary infrastructures linking institutional arrangements with educational practices and outcomes. Teaching quality and school management emerge from interactions among technology, institutions, and actors, highlighting that LMS impacts are conditional on governance, professional culture, and policy priorities.

4. Comparative analysis

4.1. China: centralized governance

Educational digitalization in China is marked by strong national coordination and centralized policymaking. Initiatives such as the Education Informatization 2.0 Action Plan and the National Education Digitalization Strategic Action Plan position LMS as key infrastructures for modern governance and standardized teaching [13]. LMS functions not only as a teaching tool but also as a mechanism for coordination, compliance, and integral components of the broader digital governance architecture. In practice, LMS adoption in China is often institutionally mandated or strongly encouraged at the national and local levels. Schools are usually required to adopt designated platforms or align their practices with unified national or provincial systems. Therefore, teachers'

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use of LMS is closely related to institutional expectations, administrative supervision, and performance evaluation mechanisms. From an institutional perspective, LMS operates as a coordination and compliance mechanism that embeds teaching activities into standardized digital workflows. This centralized approach facilitates rapid, large-scale implementation and enables comprehensive data integration across schools and regions. Data generated through LMS can be used for system-level monitoring, policy evaluation, and administrative supervision, thereby enhancing the governance capacity of educational authorities [14]. However, existing studies caution that excessive standardization may constrain pedagogical flexibility and teacher autonomy, especially when LMS usage prioritizes reporting and compliance over instructional innovation [15].

Therefore, in the Chinese context, the effectiveness of LMS in improving teaching quality depends heavily on teachers' digital capabilities and the level of professional support. Without continuous training and teaching guidance, LMS use may be superficial, limited to content delivery and administrative reporting, and unable to foster meaningful classroom interaction or student participation [5]. This highlights the conditional nature of LMS impacts in centralized governance systems, where institutional coordination alone is insufficient to guarantee pedagogical transformation.

4.2. United States: decentralization and market orientation

In contrast, LMS development and adoption in US exhibit a highly decentralized and market-oriented pattern. Education governance is marked by substantial local autonomy, with each state, school district, and even individual school having the right to choose and adopt LMS according to local needs, budgets, and teaching priorities. Thus, a diverse and competitive LMS ecosystem has emerged [16]. Teachers typically have considerable autonomy in deciding how and to what extent LMS functionalities are integrated into classroom practice, emphasizing the independence of teaching. However, after the pandemic, more teachers were required to use LMS because of the world trend [17]. This model offers flexibility and adaptability to local educational contexts, allowing schools to tailor LMS use to specific teaching goals. At the same time, decentralization can lead to system fragmentation and unequal access to digital resources. Variations in funding levels, technological infrastructure, and opportunities for teacher professional development may result in uneven LMS effectiveness across regions and schools.

5. Research propositions

Based on the conceptual framework and comparative analysis, this paper advances four propositions to guide future empirical research on how LMS affects teaching quality and school management under different institutional conditions.

• Proposition 1: Institutional Adoption Proposition. LMA adoption patterns are shaped more by national governance structures than by technical availability. Centralized systems implement LMS in standardized and coordinated ways, while decentralized systems show greater institutional variation. Governance structures define both the intended functions of LMS and the extent of discretion available to schools and teachers.

• Proposition 2: Conditional Teaching Quality Proposition. The impact of LMS on teaching quality depends on teachers' digital capabilities and professional support, rather than on usage intensity alone. Meaningful improvement occurs only when teachers have the skills and institutional conditions to integrate LMS into pedagogically substantive practices.

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• Proposition 3: Differentiated Management Proposition. LMS enhances school management through institution-specific mechanisms: in centralized systems, it strengthens coordination and compliance; in dencentralized systems, it more often reduces administrative burdens. Management outcomes therefore reflect institutional priorities rather than uniform technical outcomes.

• Proposition 4: Institutional Embeddedness Proposition. The educational impacts of LMS may vary across policy environments and professional cultures. Technological outcomes are shaped by governance structures, institutional norms, and contextual conditions rather than by technology itself.

These propositions collectively position the LMS as an institutionally embedded infrastructure whose impacts vary systematically in different environments.

6. Conclusion

Based on a comparative analysis of China and the United States, this study develops a socio-institutional framework to explain the varied impacts of LMS across national contexts. It concludes that LMS are not neutral technologies with universal effects but institutionally embedded infrastructures whose influence on teaching quality and school management is conditional, shaped by governance structures, policy priorities, and teacher agency. The analysis offers both theoretical and practical implications. Theoretically, it moves beyond technological determinism by foregrounding institutional conditions and integrating insights from socio-technical systems theory and comparative institutionalism. Practically, it suggests that policymakers align LMS investments with supportive institutional arrangements, including sustained teacher professional development and thoughtful governance of data practices. This conceptual study has limitations, primarily its lack of empirical testing. Future research should pursue empirical validation through large-scale comparative and longitudinal studies using mixed methods. Further investigation could also extend to the interaction between LMS and emerging technologies like AI and to contexts beyond the centralized-decentralized dichotomy explored here.

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