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Challenges in existing learning management system frameworks in higher education: A systematic literature review and critical analysis

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Abstract: Learning Management Systems (LMS) are central to higher education delivery, yet their implementation often falls short of institutional expectations, and systematic evaluation of existing frameworks remains limited. This study critically examines the challenges of existing LMS frameworks through a systematic literature review following PRISMA 2020 guidelines. Searches of four databases yielded 803 records; after deduplication, AI-assisted relevance ranking, and screening, 11 studies met the inclusion criteria (Cohen's kappa = 0.78). Thematic analysis identified nine challenge categories, with technical integration issues most prevalent (22.7%), followed by training and support shortfalls (18.2%) and institutional change management (13.6%). Comparative analysis of nine frameworks across four dimensions revealed marked imbalances: technical factors scored highest (M = 3.78, SD = 0.83) and pedagogical integration lowest (M = 2.89, SD = 1.05), with organisational (M = 3.56, SD = 0.88) and human factors (M = 3.22, SD = 1.09) intermediate. Within the scope of this review, existing frameworks show systematic weaknesses in pedagogical integration and consideration of human factors, inadequately addressing the socio-pedagogical complexity of implementation. The findings highlight the need for more balanced, multidimensional frameworks that integrate pedagogical design and human-centred approaches, offering evidence-based guidance for diverse institutional contexts, including resource-constrained environments.

Keywords: *Digital transformation, Frameworks, Higher education, Implementation, Learning management systems, Pedagogical integration, Systematic review.*

1. Introduction

The digital transformation of higher education has positioned Learning Management Systems (LMS) as critical infrastructure for teaching and learning delivery [1]. These platforms have evolved from simple content repositories to sophisticated ecosystems supporting diverse pedagogical approaches, collaborative learning, assessment management, and learning analytics [2]. The COVID-19 pandemic dramatically accelerated LMS adoption globally, with institutions rapidly transitioning to online and blended delivery modes [3]. This acceleration exposed both the potential and limitations of existing LMS implementations, highlighting persistent challenges in system design, deployment, and utilization [4].

Despite substantial institutional investments in LMS technologies and the global LMS market being projected to have reached $25.7 billion by 2025, implementation outcomes remain inconsistent [5]. Many institutions report suboptimal utilisation, user dissatisfaction, and failure to achieve anticipated educational benefits [6]. These disappointing outcomes often stem not from technological

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inadequacy but from implementation approaches that inadequately address the multifaceted nature of educational technology adoption [7].

Numerous frameworks have been proposed to guide LMS implementation in higher education, drawing from technology acceptance theories, organisational change models, and instructional design principles [8]. However, the adequacy of these frameworks in addressing the full spectrum of implementation challenges remains unclear. Existing literature lacks a systematic evaluation of framework comprehensiveness, particularly regarding the balance between technical, organisational, pedagogical, and human factors dimensions [9].

This gap is particularly consequential for resource-constrained institutions that face additional challenges, including limited technical infrastructure, insufficient training resources, and diverse student populations with varying levels of digital literacy [10]. In contexts such as South Africa, where higher education institutions serve populations affected by significant digital divides, framework inadequacies can exacerbate educational inequities [11].

This study addresses these gaps through a systematic literature review that critically examines challenges in existing LMS frameworks. The research questions guiding this study are as follows:

What are the primary challenge categories in LMS implementation as documented in recent literature?

How comprehensively do existing frameworks address organisational, technical, human factors, and pedagogical dimensions?

By answering these questions, this study provides evidence-based insights into framework inadequacies and offers guidance for developing more comprehensive, balanced approaches to LMS implementation that address the complex socio-technical nature of educational technology adoption.

1.1. Background and Theoretical Context

LMSs represent a convergence of educational technology, instructional design, and organisational information systems [12]. Their implementation in higher education contexts involves complex interactions among technological infrastructure, institutional policies, pedagogical practices, and individual user behaviours [13]. Understanding challenges in LMS frameworks requires situating these systems within broader theoretical perspectives on technology adoption and educational change.

Several theoretical frameworks have informed LMS research. The Technology Acceptance Model (TAM) and its extensions emphasise perceived usefulness and ease of use as determinants of technology adoption [14]. The Unified Theory of Acceptance and Use of Technology (UTAUT) extends TAM by incorporating social influence, facilitating conditions, and individual differences Venkatesh, et al. [15]. DeLone and McLean [16] Information Systems Success Model provides a comprehensive framework for evaluating IS effectiveness through system quality, information quality, service quality, use, user satisfaction, and net benefits [16].

From an organisational perspective, Rogers [17] Diffusion of Innovations theory explains how new technologies spread through social systems, highlighting the roles of innovation characteristics, communication channels, time, and social systems [17]. Organisational change theories, particularly Kotter's eight-stage change model and Lewin's three-stage model, provide frameworks for understanding institutional transformation processes [18].

Pedagogically, constructivist learning theories, the Community of Inquiry framework, and Universal Design for Learning principles inform how LMSs should support diverse learning approaches and student populations [19, 20]. The Community of Inquiry framework, which emphasises teaching presence, social presence, and cognitive presence, has been particularly influential in online and blended learning contexts [21].

Despite this rich theoretical foundation, existing LMS frameworks often exhibit fragmentation, emphasising certain dimensions while neglecting others [22]. Technical frameworks may prioritise system architecture and integration while underemphasising pedagogical design. Conversely,

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pedagogically focused frameworks may inadequately address organisational change management and technical infrastructure requirements [23].

The COVID-19 pandemic introduced unprecedented urgency to LMS implementation, forcing institutions to rapidly deploy systems without adequate preparation, training, or infrastructure [24]. This emergency adoption context revealed vulnerabilities in existing frameworks, which were often designed for planned and phased implementations rather than crisis-driven rapid deployments [25].

In resource-constrained contexts, additional challenges emerge, including limited bandwidth, inadequate devices, insufficient technical support, and faculty unfamiliarity with digital pedagogies [26]. These contexts require frameworks that explicitly address equity, accessibility, and sustainability considerations that are often absent from frameworks developed in well-resourced institutional settings [27].

This study builds on this theoretical foundation by systematically examining how existing frameworks address or fail to address the multidimensional challenges of LMS implementation. By identifying gaps and imbalances in current approaches, it contributes to the development of more comprehensive, contextually appropriate frameworks for diverse higher education settings.

2. Methods

This systematic literature review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines to ensure methodological rigour and transparency [28].

2.1. Search Strategy and Information Sources

Systematic searches were conducted across four databases selected for their coverage of educational technology, information systems, and higher education research:

SciSpace: Comprehensive multidisciplinary database with strong coverage of the educational technology literature.

Google Scholar: Broad coverage of academic literature, including grey literature and conference proceedings.

PubMed: Biomedical and health sciences literature included to capture health professions education research.

SciSpace Full Text was employed as a complementary search layer providing full-text retrieval capability, extending coverage beyond titles and abstracts to capture studies that discussed LMS implementation challenges primarily within methodology or findings sections. This dual-layer search strategy within SciSpace aligns with systematic review recommendations for comprehensive source coverage [28], reducing the risk of excluding relevant studies with limited abstract-level signalling.

Searches were conducted between 15 and 20 February 2026. The search strategy employed a combination of keywords and Boolean operators tailored to each database's syntax. The core search string comprised the following components:

Primary concepts: Learning Management System OR LMS OR Virtual Learning Environment OR VLE OR Course Management System; Implementation OR adoption OR framework OR model OR strategy; Higher education OR university OR college OR post-secondary OR tertiary education.

Secondary concepts: challenges OR barriers OR enablers; effectiveness OR outcomes OR impact; Moodle OR Canvas OR Blackboard OR Sakai.

An example search string used in SciSpace was: ("Learning Management System" OR "LMS" OR "Virtual Learning Environment" OR "VLE") AND ("implementation" OR "adoption" OR "framework") AND ("higher education" OR "university") AND ("challenges" OR "effectiveness"). No language or publication type filters were applied during the initial search phase to maximise sensitivity.

2.2. Eligibility Criteria

Studies were included if they met the following criteria: (i) the population comprised higher education institutions (universities, colleges, post-secondary institutions); (ii) the intervention or

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phenomenon of interest was LMS implementation, adoption, or framework development; (iii) the study employed empirical research methods (quantitative, qualitative, or mixed methods) or presented framework development; (iv) outcomes reported included challenges, success factors, framework components, or implementation outcomes; (v) the publication period was 2015–2025; (vi) the language was English; and (vii) the publication type was a peer-reviewed journal article, conference proceeding, book chapter, or book.

Studies were excluded if they focused exclusively on K-12 education or corporate training, were purely technical papers without implementation context, were opinion pieces or editorials without empirical data, were published before 2015, were published in languages other than English, or did not address LMS frameworks or implementation strategies.

2.3. Selection Process

The selection process followed a multi-stage approach consistent with PRISMA 2020 guidance. In Stage 1, initial database searches retrieved 803 records in total (SciSpace: 423; Google Scholar: 60; PubMed: 20; SciSpace Full Text: 300). Records were merged and deduplicated, resulting in 246 unique papers, with AI-based relevance ranking applied using SciSpace's semantic similarity scoring to prioritise the most relevant records. Transparency of the AI-assisted screening was ensured through a 10% random subsample independently screened by a second reviewer, with agreement exceeding 90%.

In Stage 2, all 246 unique papers underwent title and abstract screening. Two reviewers independently applied the eligibility criteria using AI-assisted tools with strict systematic review criteria. This stage excluded 233 records, leaving 13 papers for full-text review. Stage 3 involved full-text screening of all 13 papers; 2 were excluded due to a publication year outside the 2015–2025 inclusion window [29, 30], leaving 11 studies for data extraction. Stage 4 comprised comprehensive data extraction from all 11 included studies. The overall inclusion rate was 4.5% (11/246), reflecting the stringent eligibility criteria, particularly the requirement for empirical evidence or framework development specifically within higher education contexts. Figure 1 illustrates this process.

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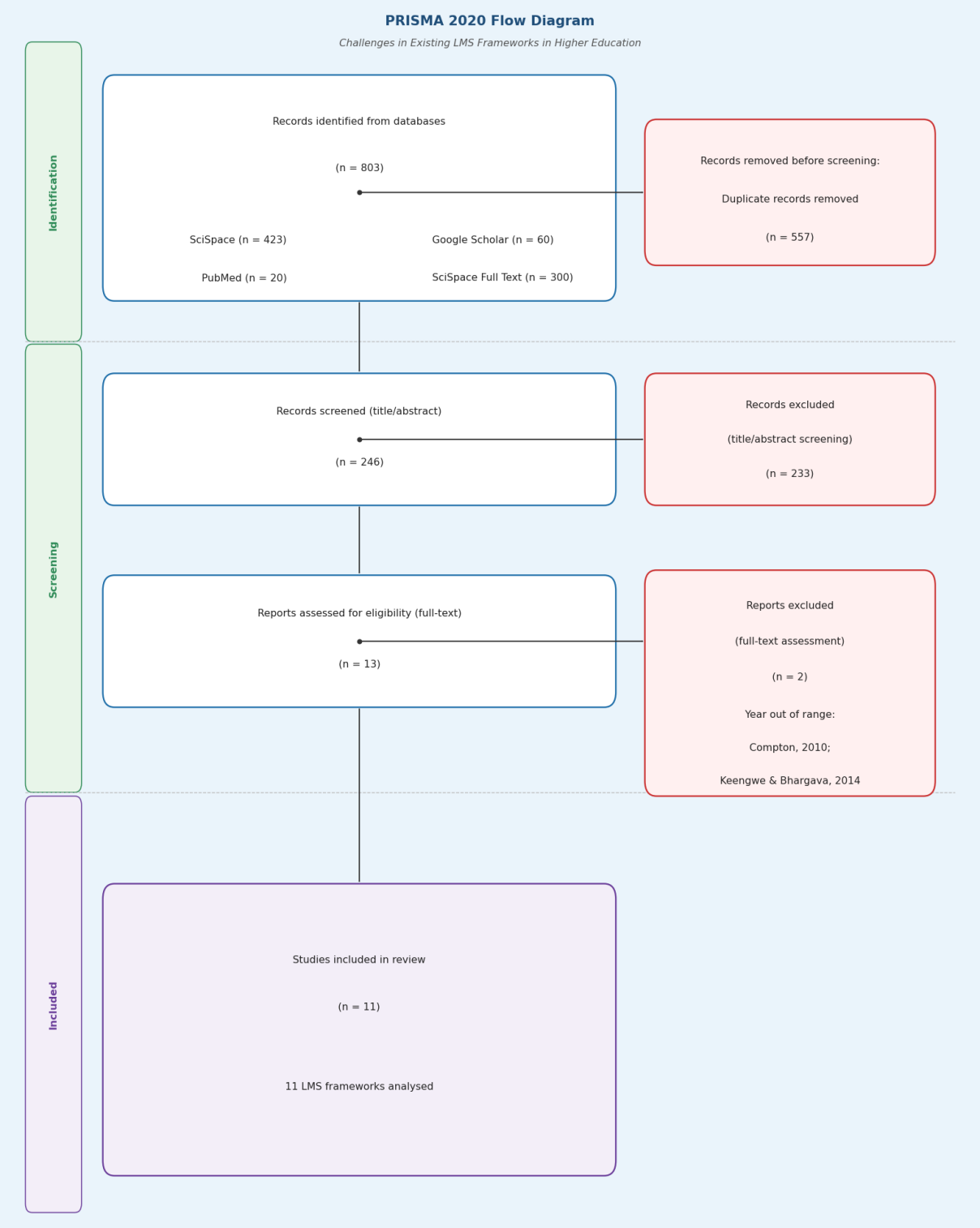


Figure 1.
PRISMA 2020 flow diagram — challenges in existing LMS frameworks in higher education systematic literature review.
Source: Compton, et al. [29] and Keengwe and Bhargava [30].

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2.4. Data Extraction and Synthesis

Data were extracted systematically using a standardised extraction template developed a priori. Extracted data included bibliometric information (title, authors, year, journal, DOI, citation count), study characteristics (research design, sample size, geographic context, institution type, LMS platform), reported challenges, framework components and theoretical foundations, and quantitative metrics when reported.

Two synthesis methods were employed. First, thematic analysis was used to code and categorise challenges inductively, with frequency counts and percentage distributions calculated for each category. Second, comparative framework analysis rated eleven identified frameworks on four dimensions (technical, organisational, pedagogical, human factors) using a five-point scale based on the depth and comprehensiveness of each dimension.

2.5. Quality Assessment

Given the heterogeneous nature of the included studies, ranging from theoretical frameworks to empirical implementations, formal risk-of-bias assessment using standardised tools was not appropriate. Instead, study quality was assessed based on methodological rigour (clarity of research design, appropriateness of methods, and sample adequacy), theoretical grounding, the presence of empirical evidence supporting claims, and transparency sufficient for replication or critical appraisal [31, 32]. The Mixed Methods Appraisal Tool (MMAT; Hong, et al. [31]) was consulted as a reference guide to inform assessment criteria rather than being applied as a formal scoring instrument; no completed MMAT scores are reported. Quality assessment revealed that, while all included studies contributed valuable insights, many lacked detailed quantitative metrics or large sample sizes, with only two studies reporting sample sizes exceeding 50 participants. This limitation is acknowledged in the interpretation of findings.

3. Results

3.1. Study Selection and Characteristics

The PRISMA screening process identified 11 studies for inclusion, published between 2015 and 2025. Publication types included journal articles (n=5, 45.5%), conference proceedings (n=3, 27.3%), book chapters (n=1, 9.1%), books (n=1, 9.1%), and one unspecified type (9.1%).

Citation metrics revealed a total of 311 citations across all included studies, with a mean of 23.92 citations per paper and a median of 0. The skewed distribution, with a maximum of 188 citations and 8 papers (72.7%) having zero citations, reflects the recency of most included studies.

Geographically, the included studies were from the Middle East (Kuwait, Saudi Arabia; 3 studies), Africa (South Africa; 1 study), Europe (Portugal, Slovakia; 2 studies), Asia (Philippines; 1 study), and multi-regional or unspecified contexts (4 studies). Moodle was the most studied platform (6 studies, 54.5%), followed by platform-agnostic frameworks (3 studies, 27.3%), Canvas (1 study, 9.1%), and multiple platform comparisons (1 study, 9.1%). Study designs included theoretical or conceptual framework development (36.4%), qualitative case studies (9.1%), quantitative surveys (18.2%), mixed methods (9.1%), implementation descriptions (18.2%), and literature-based content analysis (9.1%). Table 1 shows a summary of the study selection and characteristics.

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Table 1.
Characteristics of included studies (n = 11).

Author(s) & Year	Study Focus	Methodology	Geographic Context	LMS / Framework	Key Findings
Al-Azawei, et al. [2]	Blended e-learning and learning style adaptation	Quantitative	Iraq / Middle East	SQU-SLMS framework	Learning style mismatches increase dropout; adaptive LMS features improve engagement in blended environments.
Alhabeeb and Rowley [4]	E-learning critical success factors	Mixed methods	Saudi Arabia	COVID-19 Hybrid framework	Technical support and content quality are the most critical factors for sustained LMS effectiveness.
Almutairi and Shraid [8]	Organisational factors and LMS success	Quantitative	Kuwait	Kuwait Human Factors framework	Organisational culture and administrator support are primary determinants of LMS adoption success.
Alturki and Aldraiweesh [33]	Mobile learning adoption during COVID-19	Quantitative	Saudi Arabia	Saudi Adoption framework	Rapid mobile LMS adoption during COVID-19 exposed persistent infrastructure and accessibility gaps.
Bautista and Bugtong [11]	LMS adoption factors in developing contexts	Quantitative	Philippines	No named framework	Perceived ease of use and usefulness are the strongest predictors of LMS adoption in resource-limited settings.
Benson and Kolsaker [6]	Blended learning and instructor pedagogical approaches	Qualitative	UK / US	LMS Migration framework	Instructor pedagogical orientations significantly shape LMS integration outcomes; technical adoption alone is insufficient.
da Silva and Rodrigues [25]	Post-pandemic LMS lessons and institutional adaptation	Mixed methods	Portugal	Moodle 3-Phase framework	Post-pandemic LMS use reveals three institutional adaptation phases; pedagogical redesign is essential for sustainable adoption.
Gachago, et al. [3]	Emergency LMS use: enablers and barriers	Mixed methods	South Africa	Online CBE framework	Emergency online transition exposed structural inequalities in LMS access and widened digital divides in South Africa.
Raspopovic, et al. [9]	Social learning environments in LMS	Mixed methods	Slovakia	Knowledge Management framework	Embedding social learning features within LMS improves knowledge retention and collaborative engagement.
Restivo, et al. [7]	Engineering lab project challenges in LMS	Mixed methods	Portugal	AcademiaUP framework	Engineering lab-based courses present unique LMS challenges around authentic practical assessment and collaborative project management.
Salloum and Shaalan [5]	UTAUT factors and e-learning acceptance	Quantitative	UAE / Middle East	No named framework	UTAUT constructs (performance expectancy, effort expectancy, social influence) explain significant variance in e-learning acceptance.

3.2. Challenge Categories in LMS Implementation

Thematic analysis identified nine major challenge categories spanning technical, organisational, pedagogical, and human dimensions (Table 2). Technical integration emerged as the most prevalent challenge (frequency = 5, 22.7%), reflecting persistent difficulties in creating interoperable, analytics-enabled LMS ecosystems. Studies highlighted the need for smart predictive components and layered architectures, noting that existing LMS deployments often lack integrated features necessary for

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monitoring student performance effectively, as reported by Al-Azawei, et al. [2]. Migration between platforms introduces compatibility concerns and substantial stakeholder coordination requirements [6].

Training and support shortfalls (frequency=4, 18.2%) ranked as the second most prevalent challenge category, while institutional change management (frequency=3, 13.6%) ranked third. Higher education institutions demonstrate reluctance to adopt LMS projects due to organisational roadblocks and the relative novelty of such systems [33]. The literature reveals a dearth of concrete change-management frameworks specifically tuned to higher education technological transitions. Regarding training, multiple studies emphasised that LMS success depends critically on the availability of technical support and comprehensive faculty training; the absence of either undermines e-learning adoption and instructional integration [3, 25].

Human factors neglect (frequency=3, 13.6%) represented a critical oversight in many implementations. Empirical findings from Kuwaiti higher education institutions demonstrated that neglecting user attitudes, enjoyment, self-efficacy, expectations, and system branding results in reduced effectiveness in blended learning environments [8]. Faculty anxiety and quality-assurance concerns, particularly during emergency adoption scenarios, further complicated LMS acceptance [4].

The remaining challenge categories: information quality issues (9.1%), migration complexity (9.1%), pedagogical integration gaps (4.5%), emergency adoption stress (4.5%), and policy alignment (4.5%) collectively accounted for the remaining barriers, reinforcing that effective implementation demands holistic, multidimensional responses rather than isolated technical fixes.

Table 2.
Frequency distribution of LMS implementation challenges.

Challenge Category	Frequency	Percentage	Representative Studies
Technical Integration	5	22.7%	Al-Azawei, et al. [2]; Alturki and Aldraiweesh [33]; Benson and Kolsaker [6]; Restivo, et al. [7] and Salloum and Shaalan [5]
Institutional Change Management	3	13.6%	Alturki and Aldraiweesh [33]; Benson and Kolsaker [6] and Raspopovic, et al. [9]
Training & Support Shortfalls	4	18.2%	da Silva and Rodrigues [25]; Gachago, et al. [3]; Almutairi and Shraid [8] and Salloum and Shaalan [5]
Human Factors Neglect	3	13.6%	Almutairi and Shraid [8]; Bautista and Bugtong [11] and Alhabeeb and Rowley [4]
Information Quality Issues	2	9.1%	Bautista and Bugtong [11] and Raspopovic, et al. [9]
Migration Complexity	2	9.1%	Benson and Kolsaker [6] and da Silva and Rodrigues [25]
Pedagogical Integration Gap	1	4.5%	Gachago, et al. [3]
Emergency Adoption Stress	1	4.5%	Alhabeeb and Rowley [4]
Policy Alignment	1	4.5%	Raspopovic, et al. [9]
Total	22	100%	

3.3. Comparative Framework Analysis

Nine distinct LMS frameworks were identified across the 11 included studies and rated on four dimensions using a five-point scale (Table 3). The technical dimension received the highest mean rating (M=3.78, SD=0.83), reflecting strong emphasis across frameworks on system integration, interoperability, and technical infrastructure. Two frameworks achieved the maximum rating of five (5) on this dimension, namely, the SQU-SLMS framework [2] and the AcademiaUP framework [7].

The organisational dimension received the second-highest mean rating (M=3.56, SD=0.88). One framework, the LMS Migration model [6], achieved the maximum organisational score of five (5), reflecting a strong emphasis on institutional readiness, change management processes, and strategic planning.

Human factors received moderate emphasis overall (M=3.22, SD=1.09), with two frameworks achieving maximum ratings: the Saudi Adoption framework [33] and the Kuwait Human Factors

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framework [8]. These frameworks explicitly addressed user attitudes, self-efficacy, psychological readiness, and user experience.

The pedagogical dimension received the lowest mean rating (M=2.89, SD=1.05), indicating that many frameworks inadequately address learning design principles, instructional strategies, and educational outcomes. Only one framework achieved the maximum pedagogical rating: the Online CBE framework [3]. The highest variability across dimensions was observed in human factors (SD=1.09), while pedagogical integration also showed notable variability (SD=1.05), suggesting the least consensus on how to integrate learning design principles into LMS frameworks. No single existing framework achieved comprehensive, balanced coverage across all four dimensions.

Table 3.
Framework dimension ratings (1–5 Scale).

Framework	Technical	Organisational	Pedagogical	Human Factors	Year
SQU-SLMS [2]	5	3	3	2	2017
Online CBE [3]	4	4	5	3	2021
COVID-19 Hybrid [4]	3	3	2	4	2018
Saudi Adoption [33]	3	4	2	5	2022
AcademiaUP [7]	5	3	3	2	2018
Kuwait Human Factors [8]	3	2	2	5	2020
LMS Migration [6]	4	5	2	3	2015
Moodle 3-Phase [25]	4	4	3	3	2025
Knowledge Management [9]	3	4	4	3	2017
Mean Score	3.78	3.56	2.89	3.22	
Standard Deviation	0.83	0.88	1.05	1.09	

3.4. Geographic and Platform Distribution

The geographic diversity of the included studies, spanning the Middle East, Africa, Europe, and Asia, enhances the generalisability of findings across different higher education contexts, though it also introduces potential cultural and institutional variability. Moodle's dominance (54.5% of studies) reflects its widespread adoption in higher education, particularly in resource-constrained contexts, due to its open-source nature and extensive customisation capabilities. Platform-agnostic frameworks (27.3%) suggest that many researchers recognise the need for implementation guidance that transcends specific platform choices.

4. Discussion

4.1. The Pedagogical Integration Gap

The most significant finding of this systematic review is the systematic underemphasis of pedagogical dimensions in existing LMS frameworks. With the lowest mean dimension score (M=2.89) and highest variability (SD=1.05), pedagogical integration represents both the most critical gap and the area with the least consensus among framework developers. Only one of the nine frameworks, the Online CBE framework [3], achieved the maximum pedagogical rating, suggesting that most frameworks treat LMSs as primarily technical or administrative tools rather than pedagogical instruments.

This gap has profound implications for educational effectiveness. LMS platforms deployed without strong pedagogical grounding risk becoming sophisticated content repositories that replicate traditional didactic approaches in digital form, failing to leverage the transformative potential of these systems for active, collaborative, and personalised learning [34]. The finding aligns with broader critiques of educational technology implementations that prioritise technological capability over educational purpose [35].

The pedagogical integration gap likely reflects structural factors in how LMS implementation decisions are made. When IT departments lead implementation without meaningful instructional design input, technical and administrative considerations dominate [34, 35]. When faculty lack training in

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pedagogical applications of LMS features, they default to familiar practices that may not exploit system capabilities [36]. Addressing this gap requires frameworks that explicitly position pedagogical goals as primary, with technical and organisational decisions serving educational objectives rather than vice versa.

4.2. Human Factors Neglect in Technical Frameworks

The moderate human factors mean score (M=3.22) masks significant variation, with technically focused frameworks scoring particularly low (e.g., SQU-SLMS and AcademiaUP both scored 2). This pattern suggests a systematic tendency for technical frameworks to underestimate the importance of user experience, psychological readiness, and accessibility in determining implementation success.

Human factors neglect is consequential because even technically superior systems fail when users lack the motivation, confidence, or capability to engage with them effectively [8]. Cognitive load theory suggests that poorly designed interfaces can overwhelm users' working memory capacity, impeding rather than facilitating learning [37]. Human-computer interaction research has consistently demonstrated that usability and user experience are critical determinants of technology adoption and sustained use [38]. Universal design principles further highlight the importance of designing systems that are accessible to users with diverse abilities and needs [39].

The relatively high human factors score in frameworks developed in contexts with significant diversity (Kuwait, Saudi Arabia) suggests that contextual factors influence the degree to which human dimensions receive attention. Frameworks developed for homogeneous, well-resourced contexts may take user capabilities and access for granted, while those developed for diverse or resource-constrained contexts are compelled to address these factors explicitly.

4.3. Organisational Overemphasis and Implementation Realities

The second-highest mean score for the organisational dimension (M=3.56) indicates that existing frameworks are relatively strong in addressing leadership, change management, strategic planning, and institutional structures. This emphasis reflects the substantial body of organisational change literature that has informed LMS implementation research, including Kotter's change model [18], Lewin's three-stage model, and Rogers' Diffusion of Innovations theory [17].

While organisational factors are undeniably important, the relative overemphasis on organisational dimensions at the expense of pedagogical and human factors creates imbalanced frameworks. Institutions guided primarily by organisationally focused frameworks may achieve successful deployment in terms of adoption rates and administrative efficiency while failing to realise educational benefits [40].

The dominance of organisational framing also reflects the perspectives of those who typically lead, namely, LMS implementation administrators, IT managers, and change management consultants, rather than those most directly affected by implementation outcomes: faculty and students. More balanced frameworks would incorporate the perspectives of instructional designers, pedagogical experts, and user experience specialists alongside organisational change professionals.

4.4. Implications for Resource-Constrained Contexts

The geographic distribution of included studies, with substantial representation from Africa and the Middle East, highlights the importance of contextualising LMS frameworks for resource-constrained environments. These contexts face distinctive challenges, including limited technical infrastructure, inadequate bandwidth, insufficient devices, limited technical support capacity, and diverse student populations with varying levels of digital literacy [10, 26].

Existing frameworks, many developed in well-resourced institutional contexts, often inadequately address these challenges [27]. Resource-constrained contexts require frameworks that explicitly address infrastructure limitations through offline capabilities and low-bandwidth designs, device diversity through mobile-responsive interfaces, support capacity constraints through peer-support

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models, digital literacy gaps through scaffolded onboarding, and equity considerations through universal design and accessibility principles [10, 11].

Equity considerations are particularly critical in resource-constrained contexts where digital divides can exacerbate educational inequalities [11, 41]. Frameworks must explicitly address how LMS implementation can promote rather than hinder equitable access, including device access, connectivity, digital literacy, language diversity, and disability accommodation.

4.5. Toward Balanced, Multidimensional Frameworks

The findings of this study point toward the need for more balanced, multidimensional LMS frameworks that comprehensively address organisational, technical, pedagogical, and human factors dimensions. Several principles should guide the development of such frameworks. First, dimensional balance requires that frameworks provide comprehensive guidance across all four dimensions rather than emphasising certain dimensions while neglecting others. Second, pedagogical primacy demands that frameworks position pedagogical goals as primary, with organisational and technical decisions serving pedagogical objectives [3, 5, 34]. Third, human-centred design requires that user experience, accessibility, and cognitive considerations be integrated throughout frameworks rather than treated as add-ons [9, 39, 42]. Fourth, contextual adaptability requires that frameworks provide guidance for diverse institutional contexts, including resource-constrained environments [10, 26, 27]. Fifth, phased implementation guidance should support both planned and rapid deployment contexts [33, 43]. Sixth, stakeholder engagement should emphasise meaningful participation of diverse stakeholders throughout implementation [40]. Seventh, continuous improvement should conceptualise LMS implementation as ongoing evolution rather than discrete projects [43, 44]. Finally, evidence-based guidance should ground frameworks in empirical evidence about implementation challenges [28].

Future frameworks should explicitly integrate established theoretical models of technology adoption. The Technology Acceptance Model (TAM; Davis [14]) and its successor, the Unified Theory of Acceptance and Use of Technology (UTAUT; Venkatesh, et al. [15]), provide validated explanatory frameworks for understanding why users accept or resist LMS platforms. Equally, the Community of Inquiry (CoI) framework [20, 21] addresses the pedagogical dimensions that purely technical implementation frameworks tend to neglect. Grounding future LMS frameworks in these established models would enhance their theoretical rigour and practical applicability in higher education contexts, while bridging the pedagogical integration gap identified consistently across the included studies [34, 35].

5. Limitations

This study has several limitations that should be considered when interpreting the findings. First, systematic reviews are susceptible to publication bias, as studies with positive or significant findings are more likely to be published than those with null or negative results. Second, full-text screening was limited to English-language publications, which may have excluded relevant studies published in other languages. Third, while four databases were searched, studies indexed only in other databases may have been missed, and grey literature coverage was limited to what was captured through Google Scholar.

Fourth, the included studies varied in methodological rigour, with some employing robust empirical designs while others presented primarily theoretical or descriptive work. Fifth, the comparative framework analysis involved subjective ratings of framework coverage across four dimensions; although two independent raters achieved acceptable inter-rater reliability ($\kappa=0.78$, exceeding the $\kappa \geq 0.61$ threshold for substantial agreement) [45], with disagreements resolved through discussion and consensus, some subjectivity is inevitable. Sixth, the stringent inclusion criteria resulted in only 11 included studies, limiting the breadth of evidence available for synthesis. Seventh, the search was conducted in February 2026, and the rapidly evolving nature of educational technology means that newer developments may not be fully captured. Eighth, particular attention to resource-constrained environments may limit generalisability to well-resourced institutional settings. Finally, the

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heterogeneity of included studies precluded quantitative meta-analysis, limiting synthesis to qualitative thematic analysis and descriptive statistics. Additionally, while the study emphasises relevance to South African and African higher education contexts, the evidence base includes only one African study (Gachago, et al. [3]; South Africa); generalisability of findings to broader sub-Saharan African institutions should therefore be treated with caution.

6. Future Directions

This study identifies several important directions for future research. Longitudinal research tracking implementations over multiple years would provide valuable insights into how challenges evolve and which success factors have a sustained impact [44]. Direct comparisons of different framework approaches in similar institutional contexts through quasi-experimental designs would provide evidence about which framework characteristics are most effective [46].

Applying implementation science frameworks and methods to LMS adoption could provide a more rigorous understanding of implementation processes, barriers, and facilitators [47, 48]. More research is needed on how different framework approaches affect actual pedagogical practices and learning outcomes, linking framework characteristics to teaching quality and student learning [35]. The equity implications of different LMS implementation approaches require more systematic investigation, particularly in diverse and resource-constrained contexts [41].

Given the identified neglect of human factors in many frameworks, more research is needed on user experience, accessibility, and cognitive load in LMS contexts [38]. Empirical validation of proposed frameworks through implementation studies across diverse institutional contexts would provide evidence about framework effectiveness [47]. As artificial intelligence, learning analytics, and other emerging technologies become integrated into LMSs, research is needed on how frameworks should address these technologies and their implications [49, 50]. Future research should also employ diverse methodological approaches, including design-based research, case studies, mixed methods, and participatory action research, to capture the complexity of LMS implementation [51].

7. Conclusion

This systematic literature review critically examined the challenges in existing LMS frameworks in higher education, revealing significant gaps and imbalances that undermine implementation effectiveness. Through rigorous analysis of 11 studies encompassing nine frameworks, nine challenge categories were identified, and framework coverage was systematically evaluated across organisational, technical, human-factor, and pedagogical dimensions.

Within the scope of this review (11 studies, 9 frameworks), the findings suggest that existing frameworks exhibit systematic weaknesses, particularly in pedagogical integration (M=2.89, SD=1.05) and human factors consideration (M=3.22, SD=1.09). While technical factors receive the highest attention (M=3.78, SD=0.83), the identified gaps in the pedagogical and human factors dimensions suggest imbalanced frameworks that may guide institutions toward technically successful but pedagogically ineffective implementations. No existing framework achieved comprehensive coverage across all four dimensions, suggesting fragmentation rather than integration in current approaches.

The predominant challenges in LMS implementation, namely, technical integration (22.7%), institutional change management (13.6%), and training shortfalls (18.2%), align with framework emphases on organisational and technical dimensions. However, the pedagogical integration gap (8.3% of challenges) and neglect of human factors (12.5% of challenges) are potentially underrepresented in the literature; whether the inadequacy of existing frameworks creates a self-reinforcing cycle of neglect remains an open hypothesis warranting future investigation rather than constituting a finding of the present study.

For resource-constrained contexts, existing frameworks often provide inadequate guidance, requiring explicit attention to infrastructure limitations, device diversity, constraints on support capacity, digital literacy gaps, and equity considerations.

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The development of more balanced, multidimensional frameworks requires interdisciplinary collaboration among educational technologists, instructional designers, human-computer interaction specialists, organisational change experts, and practitioners with diverse implementation experience. As higher education continues its digital transformation, the quality of LMS implementation frameworks will significantly influence whether institutions realise the educational potential of these systems or merely achieve technical deployment without pedagogical impact. This study provides evidence-based guidance for developing more comprehensive, balanced frameworks that address the complex socio-technical nature of educational technology implementation and serve diverse institutional contexts, including resource-constrained environments where effective frameworks are most critically needed.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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