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Framework for the implementation of learning management systems in higher education institutions: A systematic literature review

Marco para la implementación de sistemas de gestión del aprendizaje en instituciones de educación superior: Una revisión sistemática de la literatura

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Abstract. Learning Management Systems – LMSs are tools that use Information and Communication Technologies – ICT to implement Virtual Learning Environments – VLEs to support institutions dedicated to the teaching-learning process. Using an LMS in virtual classrooms can improve the quality of educational products and offer a wide range of benefits; however, if not properly planned, implementation can fail. This research presents a Systematic Literature Review – SLR on LMS implementation in Higher Education Institutions – HEIs, based on 33 studies retrieved from six scientific databases. The selected articles respond to three research questions proposed in this paper. First, how is the process of implementing an LMS in HEIs carried out? Second, what are the frameworks for software implementation? Third, what are the critical success and failure factors in implementing an LMS in HEIs? The results highlight the implementation of LMS with emerging technologies and software implementation frameworks, as well as the factors that lead to the failure of LMS implementation in HEIs.

Keywords: LMS/VLE, implementation, framework, information system.

Resumen. Los sistemas de gestión del aprendizaje –*LMS*, por sus siglas en inglés–, son herramientas que utilizan Tecnologías de la Información y la Comunicación – TIC para implementar Entornos Virtuales de Aprendizaje – EVA que apoyan a las instituciones dedicadas al proceso de enseñanza-aprendizaje. El uso de un LMS en aulas virtuales puede mejorar la calidad de los productos educativos y ofrecer una amplia gama de beneficios; sin embargo, si no se planifica adecuadamente, la implementación puede fracasar. Este trabajo presenta una Revisión Sistemática de la Literatura – RSL sobre la implementación de LMS en Instituciones de Educación Superior – IES, basada en 33 estudios recuperados de seis bases de datos científicas. Los artículos seleccionados responden a tres preguntas de investigación propuestas en este trabajo. Primero, ¿cómo se lleva a cabo el proceso de implementación de un LMS en las IES? Segundo, ¿cuáles son los marcos de trabajo para la implementación de software? Tercero, ¿cuáles son los factores críticos de éxito y fracaso en la implementación de un LMS en las IES? Los resultados obtenidos destacan la implementación de LMS con tecnologías emergentes, los marcos de trabajo en la implementación de software y los factores o razones que conducen al fracaso de la implementación de LMS en las IES.

Palabras clave: *LMS*/EVA, implementación, marco de trabajo, sistema de información.

1 Introduction

The effective integration of Learning Management Systems – LMS in Higher Education Institutions – HEIs is a key aspect of the current educational transformation; for this reason, they provide essential platforms for managing and optimizing teaching and learning across face-to-face, online, and hybrid formats. Currently, the successful implementation of an LMS faces multiple fundamental challenges, including technological, organizational, and cultural ones, that must be addressed strategically to ensure effective and sustainable results from these types of educational platforms.

Importantly, the impacts of Coronavirus Disease 2019 – COVID-19, caused by Severe Acute Respiratory Syndrome Coronavirus 2 – SARS-CoV-2, on education tend to strengthen and sustain international collaborative digital learning connections on cloud-based platforms, generating opportunities for students and educators in certain

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places (Kiegaldie et al., 2022).

The inclusion of Information and Communication Technologies – ICT marks a milestone in education at all levels. HEIs are constantly updating their teaching-learning processes, among which the teacher is required to perform functions virtually when they have been programmed or when there are situations that warrant it, despite the great number of limitations and resistance to change that exists in a certain group of professionals and institutions; in the academic world it seeks to personalize the educational offer through multi-domain collaboration by teachers, scientists, and software developers (Takács et al., 2021).

Technological platforms oriented to education are designed to have accessibility and usability that allow interaction between teachers and students; there are many advantages and disadvantages to the use of virtual education, among which we can highlight accessibility in time and place, affordable cost, and available content, while isolation and too much time on an electronic device are among the drawbacks of this type of education (Aguagallo et al., 2023).

The LMS is responsible for administration, progress monitoring, activities, and evaluations of student work. At the same time, the Virtual Learning Environments – VLEs manage the creation of the virtual classroom, lesson administration, communication channels between students and teachers, administration of work at home, and the design of the work team (Takács et al., 2021).

Education is framed from VLEs to systems with automated institutional information, among which the most used for online education are LMSs, which provide a better personalization of the teaching process, reflected in positive experiences for students (Meacham et al., 2020).

In this regard, the modern world has information resources, including online learning management platforms; e-learning has been implemented in educational institutions to improve training processes, and LMSs have been widely adopted, strongly impacting higher education (Mukhametshin et al., 2019).

In this regard, it is noteworthy that research has examined the implementation of LMS in HEIs, both private and public, and has considered factors for successful implementation (Nilo Pena & Pinto Santos, 2022).

More than six million online students are enrolled in the United States, facilitating access to and flexibility in searching, filtering, and analyzing information without rigid schedules, and in developing critical thinking, creativity, collaboration, and communication skills (Chootongchai & Songkram, 2018).

An important aspect to consider is that up to 70% of software implementations fail during the implementation phase, largely due to the complexity of improving product quality. When carried out without proper planning, this results in wasted resources and effort. This is the main reason for studying the causes and shortcomings of this phenomenon: to identify when "small problems become big problems" (Anabalón R., 2005).

Although numerous studies have examined LMS from a wide range of perspectives, including technology adoption, system performance, user experience, and Information Technology – IT platform performance, there remains a notable lack of specific methodological frameworks that effectively facilitate LMS implementation in HEIs. Therefore, this study aims to make contributions at both theoretical and practical levels by presenting a comprehensive strategy that addresses the pedagogical, technological, institutional, and resource-management dimensions.

1.1 Pedagogical foundations for LMS implantation in HEI

The work by Chugh et al. (2023) on the Framework for the Implementation of Educational Technology serves as a compass for higher education institutions to design and implement robust strategies around educational technology. This study presents a framework structured around five fundamental dimensions that guide decision-making: first, the technology itself, considering its specific characteristics and functionalities; second, how it is perceived by various stakeholders, including factors that facilitate its adoption, the obstacles they face, and the challenges that arise; third, the relevant academic discipline, as technology must be adapted to the specific contexts and needs of each field of study; fourth, the indicators used to measure success, both quantitatively –pass rates, cost-benefit ratios, risk assessments– and in terms of quality evaluation; and fifth, the theoretical frameworks underpinning all of this, such as Technological Pedagogical and Content Knowledge – TPACK, the Technology Acceptance Model – TAM, and the Unified Theory of Acceptance and Use of Technology – UTAUT.

The ISO/IEC 40180 standard, issued jointly by the International Organization for Standardization – ISO and the International Electrotechnical Commission – IEC, and other quality assessment frameworks provide a versatile, scalable, and flexible international benchmark that combines quality assurance, management, and continuous improvement in information technology-mediated teaching, learning, and training processes (ISO/IEC, 2017). This standard addresses the needs of various stakeholders and operates at different levels of evaluation: institutional and national –macro–, program and course –meso–, and individual learner –micro–. For this reason, it should be incorporated into the education system's quality policies and frameworks to strengthen consistency, ensure rigorous evaluation, and achieve lasting improvements in digital education programs.

Veluvali and Surisetti (2021) propose a series of recommendations that deserve attention: it is essential to

conduct a preliminary assessment of each institution's specific needs before implementing any LMS, to appoint key figures as change agents –faculty, students, technical staff– capable of leading this transformation process, to offer training programs tailored to faculty that address the existing gaps between digital natives –students– and digital immigrants –faculty–, and to ensure a comprehensive strategic approach that integrates both the pedagogical and administrative aspects of the LMS.

Table 1 summarizes three significant studies that examine how technology is implemented in educational settings, how quality standards are ensured, and how LMSs are adopted in HEIs.

Table 1. Summary table of foundational frameworks

Work / Reference	Main focus	Key dimensions or recommendations	Contribution to educational technology and LMS implementation	Relevance to the present study
Chugh et al. (2023) – Framework for the Implementation of Educational Technology	Proposes a framework to guide higher education institutions in the design and implementation of educational technology strategies.	The framework is structured around five dimensions: technology characteristics and functionalities; stakeholder perceptions, including facilitators, barriers, and challenges; academic discipline and contextual needs; success indicators; and supporting theoretical frameworks such as TPACK, TAM, and UTAUT.	Provides a multidimensional view of educational technology implementation, integrating technological, institutional, disciplinary, evaluative, and theoretical aspects.	Supports the need for an LMS implementation framework that focuses not only on technical deployment but also on stakeholders, pedagogical alignment, institutional context, and success indicators.
ISO/IEC 40180 and quality assessment frameworks	Provides an international benchmark for quality assurance, management, and continuous improvement in technology-mediated teaching, learning, and training.	Addresses different stakeholder needs and evaluation levels: macro –institutional and national policies–, meso –programs and courses–, and micro –individual learners–.	Offers a scalable, flexible, and quality-oriented perspective for evaluating digital education processes and ensuring consistency in technology-mediated learning.	Strengthens the quality assurance component of LMS implementation by emphasizing evaluation, continuous improvement, and alignment with institutional quality policies.
Veluvali and Surisetti (2021) – Learning Management System for Greater Student Engagement in Higher Education: A Review	Reviews the role of LMS in increasing student engagement in higher education.	Recommends conducting a preliminary institutional needs assessment before LMS implementation; appointing change agents among faculty, students, and technical staff; offering faculty training programs; and integrating pedagogical and administrative dimensions.	Highlights that LMS implementation requires institutional diagnosis, faculty development, stakeholder participation, and a strategic approach that connects pedagogy and administration.	Directly supports the proposed framework by reinforcing the importance of preparation, stakeholder involvement, training, change management, and pedagogical integration in LMS implementation.

This article presents a Systematic Literature Review – SLR to identify research on LMS implementation processes, software implementation frameworks, and critical success factors. The results of this investigation will support the identification of the new characteristics that must be part of a successful LMS. For this, the following research questions are established:

- How is the LMS implementation process carried out in HEIs?
- What are the frameworks for software implementation?
- What are the critical success factors in implementing an LMS in HEIs?

The document is organized as follows: the second section contains the methodology used for this research and the information management used to identify the analysis documents. The third section presents the results achieved that resolve the research questions. The fourth section presents the discussion, including the identified limitations, followed by the fifth section, which presents the conclusions and recommendations.

2 Research design

This paper uses a methodology for an SLR proposed by Kitchenham and Charters (2007). The review protocol is shown in Figure 1 and contains six phases:

1. Formulation of research questions.
2. Review of documentation.
3. Selection of articles.
4. Extraction of relevant data

5. Application of filters with inclusion and exclusion criteria
6. Extraction of results.

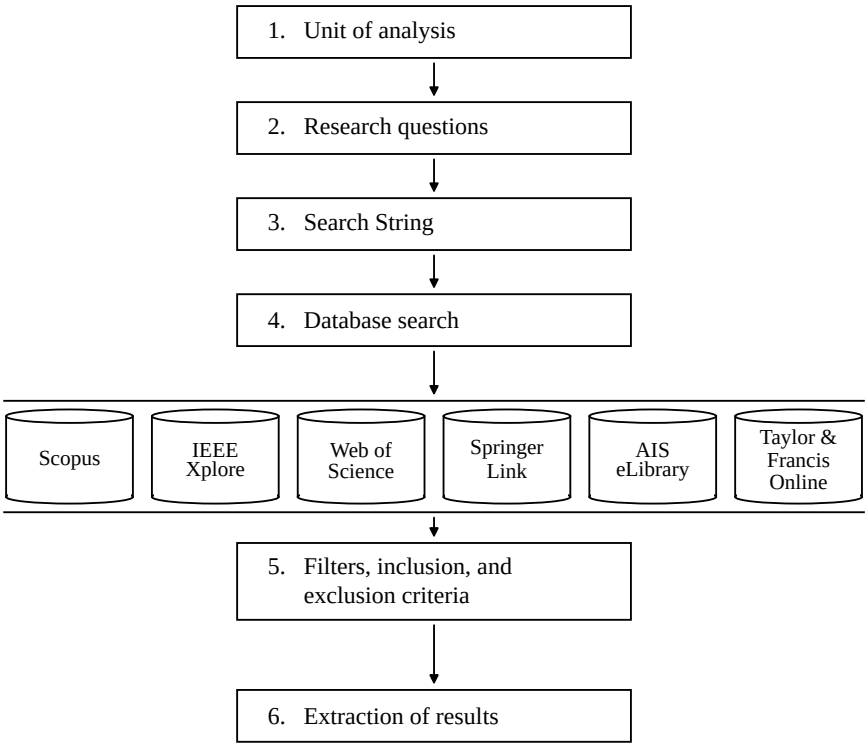


Figure 1. Protocol SLR

2.1 Unit of analysis

The unit of analysis has been defined as the –process of implementing an LMS in an HEI–, which is the first phase.

2.2 Research questions

In this SLR, three Research Questions – RQs were posed, see Table 2, that constitute the guidelines for the present study. These questions address the processes and frameworks for implementing an LMS in HEIs. The working team comprises researchers from Peru and Ecuador.

Table 2. Research questions

Item	Research questions	Motivation
RQ01	How is the process of implementing an LMS in HEIs carried out?	Identify how the LMS implementation processes have been carried out in the HEIs.
RQ02	What are the frameworks for software implementation?	To know which frameworks are used for software implementation.
RQ03	What are the critical success and failure factors in implementing an LMS in the HEIs?	Identify the failure factors in the process of implementing an LMS in HEIs.

2.3 Search string

The search strings included criteria related to temporality and the subject of computing and society to obtain better results in the SLR and support the questions of this work. The results were ordered according to date and title.

Six scientific databases were searched: Scopus (Elsevier, 2026), Web of Science (Clarivate, 2026), IEEE (2026), Springer Nature (2026), Taylor & Francis (2026), and AIS – Association for Information Systems (2023), with access provided by the *Universidad Nacional Mayor de San Marcos*, Peru, and the *Universidad Técnica del Norte*, Ecuador.

The search expression was adapted to the syntax of each of the six databases. The Scopus version was as follows:

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TITLE-ABS-KEY (process OR model OR framework OR method) AND (implementation OR
implantation) AND Learning AND Management AND System AND (LIMIT-TO (PUBYEAR, 2023) OR
LIMIT-TO (PUBYEAR, 2022) OR LIMIT-TO (PUBYEAR, 2021) OR LIMIT-TO (PUBYEAR, 2020) OR
LIMIT-TO (PUBYEAR, 2019) OR LIMIT-TO (PUBYEAR, 2018) OR LIMIT-TO (PUBYEAR, 2017)) AND
(LIMIT-TO (SUBJAREA, "COMP") OR LIMIT-TO (SUBJAREA, "SOCI")).
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The database search covered publications from 2017 to 2023 and was conducted in late 2024. Four earlier studies, published in 2005, 2011, 2012, and 2015, were retained because they directly addressed RQ03. Consequently, the 33 studies included in the review were published between 2005 and 2022.

2.4 Filters, inclusion, and exclusion criteria

Two stages are considered in this section. The first stage defined the inclusion criteria for scientific articles, literature reviews, conference proceedings, and LMS studies published from 2017 to 2023 in computer science, engineering, and educational sciences; four earlier studies were retained because of their direct relevance to RQ03. To exclude documentation, the following criteria were applied: duplicate papers, technical reports, theses, book chapters, and other areas of knowledge.

The corpus for the systematic review consisted solely of studies retrieved through the search strategy and selected after applying the inclusion, exclusion, and quality assessment criteria. These studies formed the basis for data extraction, coding, analysis, and synthesis of results. Additional references added during the manuscript review were used solely for theoretical, methodological, or contextual support; therefore, they were not included in the corpus or the systematic synthesis.

The selected articles were reviewed in a second stage to verify that the information addressed the proposed questions.

Finally, the selected scientific articles were reviewed to verify whether the information contained therein contributed to and was related to the three proposed RQs.

2.5 Extraction of relevant data

Once the previous stages were completed, the team selected and reviewed 33 unique studies. The research questions are related to the articles and were grouped for analysis and interpretation.

It is important to clarify that the corpus of the systematic literature review was composed only of the studies retrieved through the defined search strategy and selected after applying the inclusion, exclusion, duplicate removal, and quality assessment criteria. These studies were used for data extraction, coding, analysis, and synthesis of the results. In contrast, additional references incorporated during the revision process were used only to strengthen the theoretical background, methodological justification, contextual discussion, or recent updates; therefore, they were not included in the systematic synthesis.

3 Results

The articles selected above addressed the implementation process, frameworks, and LMS failures in HEIs.

In the last decade, there has been an increase in the number of new technologies applied to education (Muammar et al., 2022), as is the case with LMS, which are open-source, web-based software applications for electronic education or training courses that allow managing, tracking, reporting, and a variety of services to help instructors manage their courses at any time or place (Hasnan & Mohin, 2021; Luk et al., 2018; Kerimbayev et al., 2017). Online learning generally has a positive impact on teaching and learning, particularly in higher education, and yields greater success than traditional techniques (Hasnan & Mohin, 2021).

VLEs have been open source since the 2000s and are frequently implemented in the curricula of virtual school systems (Almutairi & Albraithen, 2018); VLEs are LMSs that reproduce most of the components of face-to-face education, such as theoretical content, practices, evaluations, individual activities, and team activities, through technological resources that favor interaction and communication between students and teachers (Takács et al., 2021).

There are many tools for implementing VLEs in LMSs, such as the Modular Object-Oriented Dynamic Learning Environment – MOODLE, a widely used open-source LMS that supports managing subject content, student control, and the virtual visualization of a VLE. The application runs on an Apache web server, with a PHP –Hypertext Preprocessor– development platform and a MySQL or Postgres database that manages users and courses in the system (Takács et al., 2021).

Blackboard (Anthology Inc., 2023), WebCT (Cavero Linares, 2026), and Desire2Learn (D2L Corporation, 2026) are proprietary software used to build and sell VLEs, based on the intellectual property license of the developer companies, in which certain key components for manipulation belong exclusively to the provider, who has the exclusive right to copy and distribute its source code (Costello, 2013).

Virtual Learning Objects – VLOs are fundamental to the teaching and learning process for developing VLE content, as they enable the selection of educational resources to improve specific student competencies (Lizarda et al., 2020).

3.1 RQ01 How is the implementation process of an LMS in HEIs carried out?

3.1.1 Implementation process

Nilo Pena and Pinto Santos (2022) report that e-learning has been implemented in educational institutions to improve training processes; the LMS is intended to meet the technological challenges of the new century, with a particularly strong impact in higher education (Nilo Pena & Pinto Santos, 2022). This study aims to identify the implementation of e-learning and LMS in HEIs through a literature review using the model of Kitchenham and Charters (2007), drawing on 30 articles from 2016 to 2022 that address research questions, with the emphasis on investing in digital literacy campaigns rather than on technology.

Kerimbayev et al. (2017) present an example of the application of electronic media that applies the principles of social constructivism, concluding that the implemented methods can be used in international cooperation, thereby adding to the teacher's workload due to the time required to maintain the resource. In the Slovak Republic, the Republic of Dagestan, and the Republic of Kazakhstan, a full-time Moodle LMS has been implemented, starting with the preparation of study materials, lectures with national and international teachers, assignments, and practicals, and ending with the exam; the main technical perception factors of this model are the development tools, LMS, information exchange systems, and educational portals. Distance education created a unique space for information and training improvement for students and generated many problems that required prompt solutions (Almutairi & Albraithen, 2018).

Luk et al. (2018) investigate the perceived usefulness of use, attitude towards behavior, and subjective norm using an augmented version of TAM that affects the behavior of using an online learning platform. It shows that technological advances have significantly changed the teaching-learning process in HEIs, with Moodle and Blackboard being the most popular platforms worldwide, and that the success of their use is grounded in students' attitudes and acceptance of technology. It concludes that the constructs studied, namely Perceived Usefulness – PU, Perceived Ease of Use – PEU, Attitude Towards Behavior – ATB, Subjective Norm – SN, Behavioral Intention – BI, and Actual Behavior – AB, obtain similar scores.

Geertshuis and Liu (2022) aim to improve the problematic situation of the HEI, adopting a new LMS and confronting the academic staff with technological challenges, where institutional support becomes an essential point to facilitate the adoption of this educational tool. The research was conducted at a New Zealand research university, where a proprietary LMS was implemented to replace a leading learning management system. The process was carried out over two years, training faculty, instructional designers, learning technologists, assistants, and temporary staff through demonstration workshops to facilitate the university-wide adoption of this new proprietary system. The research was designed as a single-case study to gather information describing contemporary experiences with the application's implementation. The results yielded emotional consequences of uncertainty and loss of efficiency; as future work, a holistic, user-centered approach to practice is recommended.

Table 3. Summary of the implementation processes

Model	Process	Authors
Main factors of technical perception	Educational content development tools, learning management systems, information exchange systems, content management systems/educational portals, and comprehensive understanding of the innovation process.	Kerimbayev et al. (2017)
Behavioral intention research tests	Factor/BI, perceived ease of use/perceived usefulness, perceived usefulness/attitude toward behavior, perceived ease of use/attitude toward behavior, perceived usefulness/behavioral intention, attitude toward behavior/behavioral intention, subjective norm/behavioral intention, and behavioral intention/actual behavior.	Luk et al. (2018)
Single case study longitudinal design	Research environment, research design, data collection, focus group participants, newsletter documents, data analysis, and results of the analysis.	Geertshuis and Liu (2022)
Inductive categories	Potential financial considerations, remedial education, sufficient institutional resources, authorized faculty, and feasibility of implementation.	Singh et al. (2019)

Table 4 presents a comparison of relevant studies on the implementation, adoption, and use of LMSs in HEIs. It summarizes their main approaches and contributions, highlighting the technological, pedagogical, organizational, and acceptance factors that influence the success of these platforms.

Table 4. Comparative analysis of LMS and e-learning implementation studies

Item	Study	Focus of the study	Main contribution
S01	Nilo Pena and Pinto Santos (2022)	Literature review on the implementation of e-learning and LMS in Higher Education Institutions, based on the model of Kitchenham and Charters (2007) and 30 studies published between 2016 and 2022.	Highlights that LMS implementation in HEIs should not focus solely on technology but also on digital literacy campaigns that strengthen teachers' and students' skills.
S02	Geertshuis and Liu (2022)	Single-case study on the institutional adoption of a new LMS in a New Zealand research university over a two-year implementation process.	Emphasizes the importance of institutional support, training, and a user-centered approach, as LMS adoption may generate uncertainty, emotional consequences, and reduced efficiency among academic staff.
S03	Kerimbayev et al. (2017)	Application of electronic media and Moodle LMS under principles of social constructivism in the Slovak Republic, the Republic of Dagestan, and the Republic of Kazakhstan.	Demonstrates that Moodle can support international academic cooperation and constructivist learning practices, although it may increase teachers' workload due to the time required to manage and maintain digital resources.

3.1.2 Virtual learning environments

Cidral et al. (2018) propose and empirically validate, using a quantitative method through equation modeling, a model that finds the determinants of user-perceived satisfaction, use, and impact of e-learning, combining DeLone and McLean's information systems theories (Delone & McLean, 2003) with e-learning systems satisfaction theory, and relying on the quality of collaboration within an integrated theoretical framework of information, satisfaction, and success of e-learning systems in HEIs and university centers in Brazil. The paper concludes that usage and user satisfaction are interdependent and have a positive impact on individual performance; furthermore, the tools should provide collaborative features and a variety of ways of learning assessment, and if the system is easy to navigate and properly structured, it will increase satisfaction with the use of the e-learning system.

Kanchana and Sri Ranjini (2018) conducted a perception analysis of teachers and students of Kabardino-Balkarian University – KBGU regarding the burden they have in distance learning in vocational education programs for secondary and higher education, also determining the individual factors of the software implementation process and applied technologies through an evaluation, which found new opportunities for academic collaboration, problems of transition to distance education, opportunities to improve learning through ICT, and communication problems between peers that were solved with emails and other means of synchronous and asynchronous communication. From an emotional perspective, students largely lose motivation due to a lack of academic follow-up, the digital gap among participants, the lack of quality and reliability in learning outcomes, and the overload of tasks for both students and teachers. It also notes that the Electronic Information Educational Environment – EIEE is one of the most effective tools for implementation in distance education.

Lizarda et al. (2020), in a work that implements a VLO with a Moodle LMS incorporating academic strate-

gies for the Accounting and Auditing career of the *Técnica del Norte* University, evaluated through a quantitative documentary study with a non-experimental and comparative descriptive scope, propose a VLO for the Financial Accounting II subject that promotes the creation of face-to-face and virtual environments for self-learning, motivation, and collaborative work, requiring teachers to make a greater effort to strengthen the digital and social skills that allow them to create a comprehensive learning environment for the design and creation of new interactive strategies that promote the use of digital resources. The authors conclude that using VLOs to develop practical exercises is one of the best options, both individually and collectively.

Monsalve-Pulido et al. (2022) note that Service-Oriented Architecture – SOA is frequently adopted in traditional systems due to rapid technological adoption, which has led to the creation of frameworks. An SOA adaptation for an educational organization is implemented using an autonomous system that extracts the institution's specific requirements. The framework uses IT with administrative controls and includes a management model that integrates intelligent mechanisms to manage the SOA across four phases: identification, design, development, and deployment. The framework was implemented by adapting a VLE, with two main processes: creating and using the course. Further implementation of the framework is proposed as future work to advance maturity, in line with the needs of academic organizations seeking to implement this architecture.

Narh et al. (2019) investigate how Virtual Platforms – VP are used in the e-learning process and evaluate how students face challenges when using VP according to their capacity, institutional factors, and external factors; the surveyed participants were students from Ghana, and the results allowed analyzing this phenomenon in two computer tools, EdX and Latitude, identifying three challenge categories: institutional, technological, and environmental factors. A quantitative method, an internet search, and interviews with people involved in e-learning processes through VP were used, with a sample of 40 individuals and a semi-structured qualitative questionnaire based on snowball sampling. The work concludes that five e-learning tools were found, namely Open EdX and Latitude Learning, which were used by the respondents, together with Cross Knowledge Learning Suite, Adobe Captivate Prime, and G-Cube LMS, and that the challenges associated with the systems fall into three categories: institutional, personal, and external; furthermore, it was identified that those involved had difficulty using a computer efficiently.

Singh et al. (2019) conceptualize e-learning as an open-source tool for the e-learning process, widely familiar to students and teachers worldwide, with tools for sharing materials and other course complements. The paper describes the use and deployment of Moodle, the monitoring options used by managers and authorities, and the automatic assessment tools at Galgotias University. The results were positive for students regarding the use of a Virtual Programming Lab – VPL, quizzes, Project-Based Learning – PBL, simulators, assignments with rubrics, virtual classrooms, feedback, and surveys. The success of these types of learning tools depends critically on teachers' knowledge and skills in using these technologies; furthermore, the authors note that future work will develop a comprehensive analysis of student performance recommendations and investigate how these tools can promote the success of the teaching and learning process.

Hasnan and Mohin (2021) implement an LMS in Malaysia, with a strong impact on e-learning; specifically, e-learning is implemented in the subject of English at Muadzam Shah Polytechnic. When inquiring about the problems of implementing blended learning using the model proposed by Kamla and Hafedh, it was identified that it is an adaptation of the original TAM; the authors also conducted semi-structured interviews with teachers in the area, identifying as main findings a lack of hardware, software, and network connection, along with problems of content organization, maintenance, system structure, inadequate management, insufficient institutional support, absence of didactic guides, digital illiteracy, and communication skills, together with a wide acceptance of the LMS in HEIs, becoming a reference to be applied in other areas of study.

Antwi-Boampong and Bokolo (2021) note that among the changes in Ghanaian HEIs since 2013 is Blended Learning – BL; the study investigates how to guide HEIs that embrace BL with policies that move from the traditional model to a fully blended model in which students and faculty members interact, taking a methodology based on institutional initiatives. The research method was a case study using a comparative-analytical approach; subsequently, the university implemented a BL policy using a Moodle LMS, identifying factors that influence the development of BL programs. In addition, it presents a guide for managers who wish to make the transition to BL in five categories: potential financial consideration, supportive pedagogy, sufficient institutional resources, willing faculty, and feasibility of implementation. As future work, it is recommended that the model be validated in universities with a track record.

The research by Kiegaldie et al. (2022) aimed to develop, implement, and evaluate a Collaborative Online International Learning – COIL program with Australian and Canadian students, measuring participants' opinions in a program that would allow communication between students and teachers to share resources with Augmented Reality – AR applications within the classroom that support collaborative and intercultural learning, using a blended approach across six modules, four existing ones, namely the verbally aggressive person, the deteriorating patient, the cognitively impaired patient, and palliative and end-of-life care, and two new ones, namely indigenous health and global health, based on pre- and post-test surveys and semi-structured interviews; the results will allow for the improvement of COIL programs.

Table 5. Summary of virtual learning environments

Model	Process	Authors
Delone and McLean (2003) model: system quality	Student computer anxiety, instructor attitude toward e-learning, diversity in evaluation, and perceived student interaction with others.	Cidral et al. (2018)
Vital factors in ERP selection, implementation, and satisfaction	Organizational efficiency and productivity, big bang methodology for implementing ERP systems, improving ERP systems, and opting for well-known vendors such as SAP.	Kanchana and Sri Ranjini (2018)
Quantitative, documentary, descriptive, non-experimental, and comparative paradigm	Data collection, diagnosis of the sample, and data analysis.	Lizarda et al. (2020)
SOA management	Identification, design, development, and deployment.	Monsalve-Pulido et al. (2022)
Challenge categories	Institutional, personal, and external.	Narh et al. (2019)
Evaluation models	VPL, quizzes, and PBL.	Singh et al. (2019)
TAM adoption: main findings	Lack of hardware, lack of software, network connection problems, content organization, maintenance, system structure, inadequate management, insufficient institutional support, lack of didactic guides, digital illiteracy, and communication skills.	Hasnan and Mohin (2021)
Inductive categories	Financial considerations, remedial education, sufficient institutional resources, authorized faculty, and feasibility of implementation.	Singh et al. (2019)
COIL model	Existing modules: the verbally aggressive person, the deteriorating patient, the cognitively impaired patient, and palliative and end-of-life care. New modules: Indigenous health and global health.	Kiegaldie et al. (2022)

Table 6 compares studies related to e-learning, LMS, Moodle, blended learning, and virtual platforms in higher education. It summarizes their methodological approaches and main contributions, highlighting factors such as satisfaction, acceptance, collaboration, infrastructure, digital competencies, institutional management, and instructional design.

Table 6. Comparative analysis of e-learning, LMS, and blended learning studies

Item	Study	Focus of the study	Main contribution
S01	Cidral et al. (2018)	Empirical validation of the determinants of perceived satisfaction, use, and impact of e-learning through structural equation modeling, integrating the IS success model of Delone and McLean (2003) with e-learning satisfaction theories.	Demonstrates that system use and user satisfaction are interdependent and positively influence individual performance; highlights the importance of collaborative tools, diverse assessments, ease of navigation, and a well-structured system.
S02	Kanchana and Sri Ranjini (2018)	Analysis of teachers' and students' perceptions of the burden and challenges of distance learning in vocational, secondary, and higher education contexts.	Identifies opportunities for academic collaboration and ICT-supported learning, but also reveals problems related to motivation, academic follow-up, the digital divide, task overload, communication, and the reliability of learning outcomes.
S03	Lizarda et al. (2020)	Implementation of a virtual learning object in the Moodle LMS for the Financial Accounting II course at *Universidad Técnica del Norte*, using a quantitative, documentary, non-experimental, and descriptive-comparative approach.	Proposes a virtual learning object that supports self-directed learning, motivation, and collaborative work; highlights the need for teachers to strengthen their digital and social skills.
S04	Monsalve-Pulido et al. (2022)	Adaptation of service-oriented architecture to an educational organization through a framework based on autonomous systems and institutional requirements.	Presents a four-phase framework –identification, design, development, and deployment– that integrates IT, administrative controls, and intelligent mechanisms.
S05	Narh et al. (2019)	Study of the use of virtual platforms in e-learning and the challenges faced by students in Ghana, considering institutional, technological, personal, and external factors.	Identifies several e-learning tools, including Open edX, Latitude Learning, CrossKnowledge Learning Suite, Adobe Captivate Prime, and G-Cube LMS; classifies the main challenges of using virtual platforms.
S06	Singh et al. (2019)	Description of the use and deployment of Moodle at Galgotias University, including monitoring, assessment tools, and learning support resources.	Shows positive student perceptions of VPL, quizzes, PBL, simulators, rubrics, virtual classrooms, feedback, and surveys.

Item	Study	Focus of the study	Main contribution
S07	Hasnan and Mohin (2021)	Application of an LMS for English language teaching in Malaysia, analyzed through an adapted Technology Acceptance Model and semi-structured interviews.	Identifies implementation barriers, including a lack of hardware, software, network connectivity, content organization, maintenance, institutional support, digital literacy, and communication skills.
S08	Antwi-Boampong and Bokolo (2021)	Case study of the transition from traditional to blended learning in a Ghanaian higher education institution through the implementation of a Moodle-based policy.	Provides guidance for institutions adopting blended learning: financial considerations, supportive pedagogy, institutional resources, faculty willingness, and implementation feasibility.
S09	Kiegaldie et al. (2022)	Development, implementation, and evaluation of a Collaborative Online International Learning program with Australian and Canadian students, supported by blended learning and augmented reality resources.	Contributes to the design of intercultural and collaborative learning experiences through six modules, evaluated with pre-tests, post-tests, and semi-structured interviews.

3.1.3 Use of emerging technologies

The work of Riemann et al. (2020) establishes the concept of learning factories using Virtual Reality – VR, offering the opportunity to learn in virtual spaces that simulate physical spaces to substantiate training courses in the learning factory called Center for Industrial Productivity. The requirements were evaluated through a survey of experts using the KANO model, classifying them as –one-dimensional, attractive, essential, and indifferent–, as summarized in Table 7. A value stream analysis of a customized VR exercise is proposed for future research.

The study by Bordeleau et al. (2021) conducts a framework review of Digital Transformation – DT models related to Industry 4.0, supported by emerging technologies that allow organizations to generate innovations with additional value at many levels, becoming more sustainable, intelligent, and, above all, socially oriented –known as S4– which allows academics to represent a DT structure, although with limitations due to a maturity level that has not yet been reached despite its rapid evolution. Future work aims to explore empirical applications to help managers guide DT strategies.

Table 7. Use of emerging technologies

Model	Process	Authors
Minimum requirements –product backlog–	Identification, classification, sequencing, implantation, attachment, and tests.	Riemann et al. (2020)
Objectives of digital transformation	Detection, intelligent, sustainable, and social.	Bordeleau et al. (2021)

Table 8 compares studies on digital transformation, virtual reality, and Industry 4.0. It summarizes their main approaches and contributions, highlighting the use of emerging technologies to strengthen learning processes, drive organizational innovation, advance sustainability, and enhance digital maturity.

Table 8. Comparative analysis of virtual reality and digital transformation studies

Item	Study	Focus of the study	Main contribution
S01	Riemann et al. (2020)	Analysis of learning factories supported by virtual reality, specifically at the Center for Industrial Production, where virtual spaces simulate physical environments for training purposes; requirements were identified through a systematic literature review and evaluated by experts using the KANO model.	Provides a classification of requirements for implementing VR in learning factories and contributes to the design of immersive training environments that support industrial learning processes.
S02	Bordeleau et al. (2021)	Review of digital transformation frameworks related to Industry 4.0 and supported by emerging technologies, with emphasis on innovation, sustainability, intelligence, and social orientation.	Proposes a structured view of digital transformation models within the Industry 4.0 context, highlighting their potential to guide organizations toward sustainable, intelligent, and socially oriented transformation processes.

A summary of articles on implementation processes, virtual learning environments, and the use of emerging tools is shown in Table 9.

Table 9. Studies associated with RQ01

Technique	Research questions	No. of items
Implementation processes	Nilo Pena and Pinto Santos (2022), Kerimbayev et al. (2017), Luk et al. (2018), Geertshuis and Liu (2022)	4
Virtual learning environments	(Cidral et al., 2018), Kanchana and Sri Ranjini (2018), Lizarda et al. (2020), Monsalve-Pulido et al. (2022), Narh et al. (2019), Singh et al. (2019), Hasnan and Mohin (2021), Antwi-Boampong and Bokolo (2021), Kiegaldie et al. (2022)	9
Use of emerging technologies	Riemann et al. (2020), Bordeleau et al. (2021)	2

3.2 RQ02 What are the frameworks for software implementation?

3.2.1 Artificial intelligence

Harfouche et al. (2018) state that the ability to analyze data in organizations has become possible due to recent advances in Artificial Intelligence – AI. The article develops an organizational framework using AI for the creation of knowledge from a literature synthesis, in five stages –collect, curate, ingest, train/test, and analyze/predict–, implementing a multi-agent AI in a project called SCHOPPER –*Simulation des Comportements des Hommes Préhistoriques dans leur Paléo-Environnement Pour la Recherche*–, which includes academics and practitioners developing innovative AI solutions to validate or reject hypotheses of human behavior in an immersive environment. Two main practices are identified: the ability to initiate a dialogue with different actors, and the recursive capability that is inseparable from the learning process, establishing a relationship between an individual and artificial knowledge, resulting in a human-AI interaction across five stages: extraction and collection, selection, ingestion, training and testing, and analysis and prediction.

Ghnemat et al. (2022) note that Artificial Intelligence in Education – AIED has completely changed the future of education, with AI technology platforms and collaborative teachers managing the classroom environment and possibly replacing classroom work with automated assessments that solve research and application problems. The article outlines a revolutionary educational method, AI-based Learning, that aims to reduce the digital divide between HEI learning outcomes and industry. It proposes a framework with inputs, outputs, and transformation steps, specifies the benefits of implementation, and provides a comparative analysis after applying the framework. It uses competency-based learning as a pedagogical approach, enabling students to achieve course outcomes more easily and quickly. Future work is proposed to extend and analyze the impact of the transformation process in a university, and to analyze descriptive applications and their effects on the proposed transformation.

Table 10. Summary of artificial intelligence implementation frameworks

Model	Process	Authors
SCHOPPER model stages	Extraction and harvesting, selection, intake, training and testing, and analysis and prediction.	Harfouche et al. (2018)
Proposed framework	Inputs: students, instructors, and technical team. Processes: quality management center, e-learning centers, educational intelligence recommendation system, and artificial intelligence research centers. Outputs: instructors and technical teams trained in AI technology, personalized learning tools, and reusable data and generalized models.	Ghnemat et al. (2022)

Table 11 compares studies on artificial intelligence, knowledge creation, and educational transformation. It summarizes their main approaches and contributions, highlighting human–AI interaction, AI-based learning, reducing digital divides, and strengthening competencies in higher education.

Table 11. Comparative analysis of artificial intelligence and education studies

Item	Study	Focus of the study	Main contribution
S01	Harfouche et al. (2018)	Development of an organizational framework based on Artificial Intelligence for knowledge creation, proposing a five-stage process –collection, curation, ingestion, training and testing, and prediction analysis– and presenting the SCHOPPER project.	Contributes a human-AI interaction framework for organizational knowledge creation, highlighting two key practices: initiating dialogue among different actors and the recursive capacity for learning.
S02	Ghnemat et al. (2022)	Proposal of an AI-based learning framework aimed at transforming education through Artificial Intelligence in Education, focused on reducing the gap between higher education learning outcomes and industry needs.	Provides a framework with inputs, outputs, and transformation steps for implementing AI-based learning in higher education, supporting alignment between universities and industry requirements.

3.2.2 Use of emerging tools in learning frameworks

Checa et al. (2020) show that the progressive price reduction of VR technology has promoted its use in video games and has also driven its application in the development of educational applications. The authors present an immersive VR framework for the design of an educational experience; the framework includes all the tasks required to create player movements with VR and has been implemented in two case studies related to cultural heritage. The metrics of this framework focus on final validation by students, which is identified as a weakness and is intended to be revised and validated for integration in future work.

Table 12. Summary of the use of emerging tools in learning frameworks

Model	Process	Authors
User performance elements	Key evaluation factors: the evaluation method, the number of people who test the serious game, and the presence or absence of a control group.	Checa et al. (2020)

Table 13 summarizes the study by Checa et al. (2020) on the use of immersive virtual reality in educational experiences. It highlights its application in video games, cultural heritage, and the design of learning environments, as well as the need to strengthen its validation processes.

Table 13. Comparative analysis of immersive virtual reality in educational applications

Item	Study	Focus of the study	Main contribution
S01	Checa et al. (2020)	Proposal of an immersive virtual reality framework for designing educational experiences, implemented in two cultural heritage case studies.	Provides a framework to support the creation of player movement and immersive interactions in VR-based educational environments; identifies the need to expand validation metrics beyond final student evaluations.

3.2.3 Frameworks for LMS applications

Chootongchai and Songkram (2018), who designed and implemented a VLE in higher education to improve students' thinking skills and innovation, establish three objectives: to design a system and functional architecture diagram for online learning, to implement a management system with the LMS Moodle, and to evaluate the system for the development of students' innovative thinking skills, using interviews as an evaluation instrument before and after applying the test. A significant statistical difference was found between the two measurements, with $p = 0.01$, indicating positive results for thinking skills in online learning.

Meacham et al. (2019) present a framework for educators to create and configure a VLE in any discipline, established in three stages: in the first stage, an analysis is developed that allows parameterizing the VLE; in the second stage, data analysis treatment is performed on the collected information; and in the third stage, the VLE is customized. The work combines two environments to take full advantage of their respective specializations; the proposed framework was tested with 20 educators, who provided comments that enabled the collection of more relevant data for analysis. The long-term research aims to create a VLE language that can adapt, applying a data science algorithm to process learning analytics, with human participation in final, critical decisions by experts in the application area. Future work is intended to expand to emerging computer applications.

Meacham et al. (2020) argue that the lack of customization has discredited online education, and their paper presents an Adaptive Virtual Learning Framework that enables educators to create adaptive VLEs across disciplines tailored to their needs. The paper proposes developing a new language using MPS –Meta Programming System–,

the JetBrains development environment for Domain-Specific Languages – DSLs, elaborated in the following stages: AdaptiveVLE design, AdaptiveVLE implementation, deployment of an educational environment, data collection, data processing, and AdaptiveVLE adaptation. Future work intends to constitute a generic framework for adaptive systems and usability testing across applications.

Gupta et al. (2019) present human-centered cybernetic learning frameworks with VR adapted to two educational domains: immersive and haptic media training for orthopedic surgery, and science learning for children with autism. Expert surgeons designed the use cases, and resident physicians carried out the implementation; educational psychologists elaborated the content design; and immersive technologies played a key role in the learning process through avatars tailored to the activities, achieving positive results in surgical evaluations with cyber-humans.

Wambsganss et al. (2021) note that one of the most widespread problems of distance education is the lack of empathy and elementary skills for daily interaction, communication, agile teamwork, and leadership that are pillars for conducting educational studies, performing a systematic review in two major areas: educational technology and learning theories. The project proposes a four-phase prototype: requirements derived from scientific literature, requirements derived from interviews with students, derivation of design principles and features, and proof-of-concept evaluation. Sixty-five students were evaluated, and the results showed that the tool follows design principles that help students respond more effectively to peer feedback.

Takács et al. (2021) identify a diversity of areas in which information systems are widely used daily; business systems such as SAP, Oracle, or Microsoft Dynamics, among others, support their processes effectively, and methodologies, technologies, and tools of LMS systems such as Moodle allow the efficient implementation of courses and curricula, or the easy integration of Microsoft Teams for collaboration between students and teachers; LMS is not as standardized as commercial solutions. The authors intend to develop a framework, assisted by enterprise application project management methods, implemented through an educational framework using business methodologies and procedures. Future work will research the proper configuration and use of the Microsoft Teams environment, including security and ERP system authorization requirements.

Athauda et al. (2018) state that virtual laboratories, according to the literature, have achieved many benefits that surpass physical laboratories when implemented in courses using virtualization and cloud computing. The work analyzed the implementation of virtual laboratories and classified it into two stages: 1) technical design and evaluation, and 2) pedagogy, theories, and principles of learning based on the design. The authors present a framework that combines holistic technology and constructivist theory, following Kolb's experiential curriculum design, the learning cycle, and Bloom's taxonomy. Artifacts include labs, forums, quizzes, feedback, and an online student-teacher board for systems administration and networking courses. Evaluation of the framework in real classes is proposed as future work.

Smyrnova-Trybulska et al. (2022) mention that e-learning is very frequent and popular in today's education, presenting the adaptive learning approach and comparing Polish-Ukrainian research results, highlighting the adaptive learning implementation options offered by LMS Moodle regardless of students' country. A survey was conducted with 59 students at the University of Silesia in Katowice, Poland, and 121 students at Borys Grinchenko Kyiv University, Ukraine. The students were confined due to the COVID-19 pandemic, so classes were taught virtually in synchronous and asynchronous modes using Moodle and Microsoft Teams for Polish students, and the Google Suite for Ukrainian students. Polish students reported a lack of customization and limitations in the educational materials and learning process. As future work, an analysis of students' opinions regarding the changes introduced in the courses is proposed.

Muammar et al. (2022) use a standardized Digital Competence of Educators Framework – DigCompEdu, a validated, comprehensive questionnaire used to assess the professional skills of teachers in the use of ICT and digital competencies in the educational practices of teachers at a higher education institute in the United Arab Emirates – UAE. A 22-question survey was conducted with fewer than 100 respondents to identify a correlation between strengths and weaknesses in the use of digital technologies, thereby pinpointing areas needing further attention and establishing relative strengths. According to the results, the majority are digitally competent in the six areas of the DigCompEdu framework: professional engagement, digital resources, teaching and learning, assessment, learner empowerment, and learner facilitation. As future work, it is intended to collect more questions, establish a grouping method to segment participants by background, and investigate the relationship between competency levels and specialization.

Table 14. Summary of frameworks for LMS applications

Model	Process	Authors
SECI	Socialization, externalization, combination, and internalization.	Chanjaradwichai et al. (2019)
Customized framework using domain-specific models and data analysis	Domain-specific modeling of the VLE and implementation of the WEKA library, both for learning analytics processing.	Meacham et al. (2019)
AdaptiveVLE	AdaptiveVLE design, AdaptiveVLE implementation, deployment of an educational environment, data collection, data processing, and AdaptiveVLE adaptability.	Meacham et al. (2020)
Design and evaluation of an adaptive empathy learning tool	Requirements derived from the scientific literature, requirements derived from student interviews, derivation of design principles and features, and proof-of-concept evaluation.	Wambsganss et al. (2021)
LCMS	Tools for creating new content, tools for integrating existing content, and content availability.	Takács et al. (2021)
Use of PLTs	Curriculum design, design of teaching and learning activities, design of assessment tasks, and architecture and technological artifacts.	Athauda et al. (2018)
Adaptive learning approaches	Adaptive learning and the individualization and personalization of education, adaptive learning and ICT tools, the Moodle system in the context of learning, learning styles and multiple intelligences, and VARK learning styles and lesson design in the Moodle LMS.	Smyrnova-Trybulska et al. (2022)
DigCompEdu	Professional engagement, digital resources, teaching and learning, assessment, empowering learners, and facilitating learners' digital competence.	Muammar et al. (2022)

Table 15 summarizes studies on VLE, LMS, adaptive learning, virtual reality, virtual labs, and digital competencies. It highlights their approaches, methodologies, and main contributions to personalizing learning, strengthening skills, integrating technology, and improving educational experiences in higher education.

Table 15. Comparative analysis of VLE, LMS, and technology-enhanced learning studies

Item	Study	Focus of the study	Main contribution
S01	Chootongchai and Songkram (2018)	Design and implementation of a virtual learning environment in higher education to improve students' thinking and innovation skills, using Moodle LMS and pre-test/post-test evaluation.	Demonstrates that online learning supported by a VLE can significantly improve students' innovative thinking skills, with statistically significant results after the intervention.
S02	Meacham et al. (2019)	Proposal of a framework that allows educators to create and configure VLEs in different disciplines through analysis, data processing, and customization stages.	Provides a structured process for adapting VLEs according to disciplinary needs; highlights the role of learning analytics and expert participation.
S03	Meacham et al. (2020)	Development of an Adaptive Virtual Learning Framework using a domain-specific language with JetBrains MPS to create adaptive VLEs across disciplines.	Contributes a framework for the design, implementation, deployment, data collection, processing, and adaptation of personalized virtual learning environments.
S04	Gupta et al. (2019)	Analysis of human-centered cybernetic learning frameworks using virtual reality in orthopedic surgery training and science learning for children with autism.	Shows the potential of immersive and haptic technologies to support specialized learning experiences using avatars and cyber-human interaction.
S05	Wambsganss et al. (2021)	Design of a prototype to address the lack of empathy, communication, teamwork, and leadership skills in distance education, based on educational technology and learning theories.	Proposes design principles and features that help students respond better to peer feedback, strengthening social and communicative skills.
S06	Takács et al. (2021)	Proposal of a framework assisted by enterprise application project management methods for the implementation of LMS and collaborative environments such as Moodle and Microsoft Teams.	Highlights the need to standardize LMS implementation by adapting business methodologies, project management practices, and ERP authorization procedures to educational contexts.

Item	Study	Focus of the study	Main contribution
S07	Athauda et al. (2018)	Development of a virtual laboratory framework based on virtualization, cloud computing, constructivist theory, Kolb's experiential learning cycle, and Bloom's taxonomy.	Provides a holistic framework for virtual laboratories integrating technological design, pedagogy, labs, forums, quizzes, feedback, and online boards.
S08	Smyrnova-Trybulska et al. (2022)	Cross-border study on adaptive learning in university students from Poland and Ukraine, using Moodle, Microsoft Teams, and Google Suite during the COVID-19 pandemic.	Identifies students' expectations and limitations related to personalization, educational materials, and learning processes.
S09	Muammar et al. (2022)	Assessment of digital competence among higher education teachers in the United Arab Emirates using the DigCompEdu framework.	Contributes evidence on teachers' strengths and weaknesses in six areas of digital competence.

Table 16. Summary of the use of artificial intelligence and frameworks for LMS applications

Technique	Research questions	No. of items
Artificial intelligence	Harfouche et al. (2018), Ghnemat et al. (2022)	2
Use of emerging tools in learning frameworks	Meacham et al. (2019)	1
Frameworks for LMS applications	Chootongchai and Songkram (2018), Meacham et al. (2019), Meacham et al. (2020), Gupta et al. (2019), Wambsganss et al. (2021), Takács et al. (2021), Athauda et al. (2018), Smyrnova-Trybulska et al. (2022), Muammar et al. (2022)	9

3.3 RQ03 What are the critical success and failure factors in implementing an LMS in the HEI?

Almutairi and Albraithen (2018) indicate that ICT and the incorporation of information have changed the landscape of education, improving expectations within HEIs following the inclusion of VLE, which has become a transcendentally trending topic in education. The paper conducts a literature review of peer-reviewed articles on the success factors of LMS implementation and provides insight into the terms and definitions used in the context of virtual schools. It further indicates that a framework of critical success factors is evidently absent from the literature. The result of the systematic review reveals 15 factors across five dimensions: technology, comprising system quality, interactivity systems, ease of use, and usability; student characteristics, comprising self-efficacy and attitude; instructor characteristics, comprising attitude, teaching style, and technology control; course content, comprising course flexibility, diversity of assessment methods, and content quality; and institutional support, comprising user training, top management support, and technical support. The framework offers a reference for implementing and developing projects that incorporate e-learning as a major component in potential lines of research for educational institutions.

Anabalón R. (2005) notes that Software Process Improvement – SPI initiatives are implemented by organizations to improve the quality of their products and can yield substantial benefits; however, when not properly planned, they lead to wasted effort and delays in product development. The work aims to identify the most common causes of failure in implementation, finding that up to 70% of software implementations fail due to problems of requirements communication related to organizational culture, issues inherent to the models, specifically the Capability Maturity Model – CMM and Capability Maturity Model Integration – CMMI, and a lack of good practices. It concludes that implementation processes could improve if CMM/CMMI is used for technical, formalistic, and structural aspects; however, this model does not consider the sociological or anthropological aspects of the organizations, that is, aspects that cannot be overcome with training alone, such as motivational, communicational, and administrative skills, stress, organizational culture, and human resource management.

Díaz Piraquive et al. (2015) raise a research question seeking to identify the most frequent reasons "why IT projects fail in the world," attempting to resolve it through a review of specialized articles and research. A documentary methodology of the project life cycle is used, with the main expectation of mitigating three critical factors –scope, time, and cost– to improve the success rates of these projects. According to Gartner, 75% of IT projects fail; to improve this index, three critical areas must be considered: people, processes, and culture. It is concluded that the technological factor is, to a large extent, not a significant risk, whereas the greatest risks are human and organizational.

Ruiz and Meza Álvarez (2017) review previous works that size, structure, and organize the failure factors from the ontology and organizational structure of ERP implementation, addressing issues such as critical success factors related to human resources, vendor comparison, theory-practice, reasons, and satisfaction with the ERP. It identifies the following success factors: top management support, appropriate scope, allocation of good human resources to

the project, availability of an implementation methodology, a complete and realistic work plan, assignment of a good implementing supplier, change management, sufficient human talent, communication, and inclusion of an adequate budget to assume the risk margin. As causal factors of failure, it indicates: deficient project management, lack of participation of key areas from the beginning, planning errors, failures in data mitigation, performing non-standard developments, deficient change and risk control, lack of understanding and knowledge, lack of a quality assurance plan, and starting implementation during delicate business cycles, concluding that the human factor has the greatest impact on failure.

Kheybari et al. (2020) evaluate the reasons for the failure of information systems in HEIs, collecting the opinions of IT experts working in different HEIs in Iran using an online questionnaire based on the Best-Worst Method – BWM. Through an extensive literature review, the study classifies 38 factors that can contribute to the failure of an information system, organized in a hierarchical structure: 11 project management factors, 13 organizational management and human factors, 11 organizational factors, and 3 technical factors. As a result, it presents factors and information for university managers in Iran on failure factors that could help them make decisions to save economic resources.

Alhazmi and Rahman (2012) present a summary obtained from a bibliographical review validated by e-learning experts, in which the variables responsible for the success and failure of LMS are evidenced, providing relevant information that allows a better understanding of the needs of the LMS so that it fulfills its function of supporting the teaching-learning process in which both teachers and students feel committed to comprehensive theoretical and practical academic training. The integration of effective communication tools and the use of shared content are highlighted as essential elements that would improve the advantages of a learning manager.

Ssekakubo et al. (2011) aim to identify the causes of LMS failure through interviews with staff at five African universities; the results identify digital illiteracy as a high-impact failure factor, with usability problems, poor marketing strategies, and inadequate support identified as lower-impact factors. Future work proposes research towards the successful deployment of LMS in developing countries.

Table 17. Summary of the critical success and failure factors in implementing an LMS in HEIs

Model	Process	Authors
E-learning system success	Technology, students, instructor, courses and content, and institution.	Almutairi and Albraithen (2018)
Most common causes of failure in software implementation	Organizational, sociological, motivational, and communication capabilities; administrative capabilities; human resources management; and cultural change in the company.	Anabalón R. (2005)
Critical areas of major influence on project performance	People, processes, and culture.	Díaz Piraquive et al. (2015)
Spectral structuring of failures in ERP implementation	Lower project cost, top management communication, and project planning.	Ruiz and Meza Álvarez (2017)
Factors contributing to information system failure	Project management, organizational management and human-related factors, organizational factors, and technical factors.	Kheybari et al. (2020)
Aspects of LMS success and failure	Success: simple login, learning management, content management, integration, and security. Failure: content creation and sharing, design of communicative elements, teacher-centered structure, learner disengagement, and inflexible assessment.	Alhazmi and Rahman (2012)
E-learning implementation stages	Plan, planning, design, development and evaluation, delivery, maintenance, diagnosis, decision-making, development, delivery, and post-delivery.	Ssekakubo et al. (2011)

Table 18 compares studies on the factors contributing to success and failure in the implementation of LMS, e-learning, information systems, ERP, and IT projects. It summarizes their approaches and findings, highlighting the technological, human, organizational, institutional, and managerial dimensions that influence outcomes.

Table 18. Comparative analysis of success and failure factors in LMS, IS, and IT project implementation

Item	Study	Focus of the study	Main contribution
S01	Almutairi and Albraithen (2018)	Literature review of the success factors of LMS implementation and the definitions related to virtual schools and virtual learning environments.	Identifies 15 critical success factors grouped into five dimensions: technology, student characteristics, instructor characteristics, course content, and institutional support.
S02	Anabalón R. (2005)	Analysis of the most common causes of failure in software process improvement initiatives, especially those based on CMM/CMMI models.	Highlights that many software improvement implementations fail due to communication problems, organizational culture, model limitations, and a lack of good practices.
S03	Díaz Piraquive et al. (2015)	Documentary review focused on identifying why IT projects fail worldwide, considering the project life cycle and the critical constraints of scope, time, and cost.	Shows that the main risks of IT project failure are human and organizational rather than technological.
S04	Ruiz and Meza Álvarez (2017)	Review of success and failure factors in implementing enterprise management systems, especially ERP systems.	Identifies key success factors such as top management support, adequate scope, human resources, implementation methodology, and change management; highlights that the human factor has the greatest impact on ERP implementation failure.
S05	Kheybari et al. (2020)	Evaluation of information system failure factors in higher education institutions in Iran, using expert opinions and the Best-Worst Method.	Classifies 38 failure factors into four categories: project management, organizational management and human factors, organizational factors, and technical factors.
S06	Alhazmi and Rahman (2012)	Bibliographic review validated by e-learning experts to identify variables related to LMS success and failure.	Contributes a synthesis of favorable and unfavorable factors affecting LMS implementation, emphasizing effective communication tools and shared content.
S07	Ssekakubo et al. (2011)	Study of the causes of LMS failure in five African universities, based on interviews with university staff.	Identifies digital illiteracy as a high-impact failure factor, along with usability problems, poor marketing strategies, and inadequate support.

Table 19 presents studies related to RQ03, which aims to identify the reasons for LMS failures in HEIs. The figures in the table correspond to the relevant studies included in the systematic literature review that address this research question.

Table 19. Studies associated with RQ03

Technique	Research questions	No. of items
What are the reasons that lead to the failure of LMS in HEI?	Kerimbayev et al. (2017), Anabalón R. (2005), Díaz Piraquive et al. (2015), Ruiz and Meza Álvarez (2017), Kheybari et al. (2020), Alhazmi and Rahman (2012), Ssekakubo et al. (2011)	7

Table 20, summarizes the distribution of the selected studies across the research questions. RQ01 is addressed by 15 studies, RQ02 by 11, and RQ03 by 7. Because Kerimbayev et al. (2017) contributes to both RQ01 and RQ03, these values represent 34 study–RQ associations derived from 33 unique studies.

Table 20. Summary of articles based on RQ

Research questions	Articles	No. of articles
RQ01	Nilo Pena and Pinto Santos (2022), Kerimbayev et al. (2017), Luk et al. (2018), Geertshuis and Liu (2022), Cidral et al. (2018), Kanchana and Sri Ranjini (2018), Lizarda et al. (2020), Monsalve-Pulido et al. (2022), Narh et al. (2019), Singh et al. (2019), Hasnan and Mohin (2021), Antwi-Boampong and Bokolo (2021), Kiegaldie et al. (2022), Riemann et al. (2020), Bordeleau et al. (2021)	15
RQ02	Harfouche et al. (2018), Ghnemat et al. (2022), Meacham et al. (2019), Chootongchai and Songkram (2018), Meacham et al. (2020), Gupta et al. (2019), Wambsganss et al. (2021), Takács et al. (2021), Athauda et al. (2018), Smyrnova-Trybulska et al. (2022), Muammar et al. (2022)	11
RQ03	Kerimbayev et al. (2017), Anabalón R. (2005), Díaz Piraquive et al. (2015), Ruiz and Meza Álvarez (2017), Kheybari et al. (2020), Alhazmi and Rahman (2012), Ssekakubo et al. (2011)	7

Note. Counts correspond to study–RQ associations. Kerimbayev et al. (2017) contributes to both RQ01 and RQ03; therefore, the 34 associations correspond to 33 unique studies.

Figure 2 visually represents this distribution, allowing a clearer comparison of the number of articles associated with each research question. Overall, the table and figure help identify which research questions have received greater attention in the literature and which areas require further investigation.

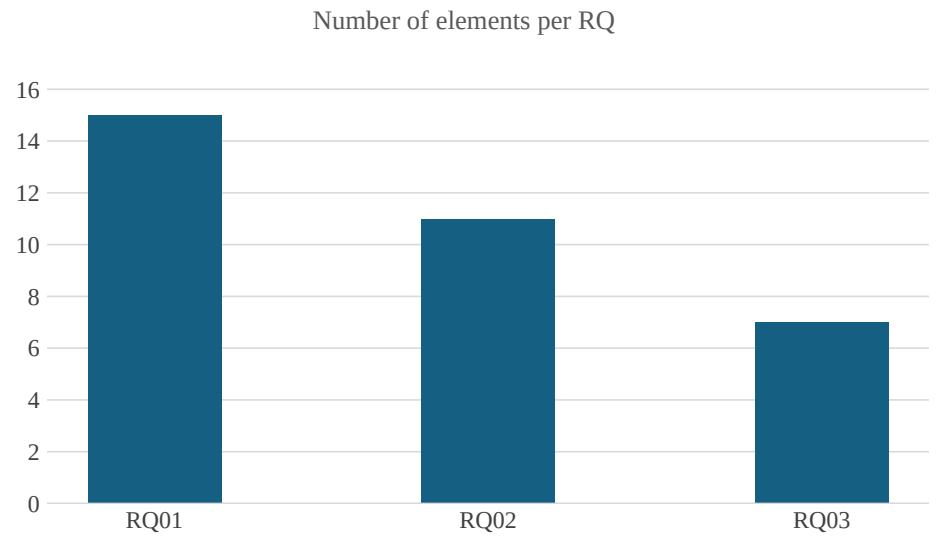


Figure 2. Number of articles by research question

The following Table 21 identifies the documents that belong to the corpus of the SLR. These studies were selected after applying the search strategy, inclusion and exclusion criteria, duplicate removal, and quality assessment process, and were used for data extraction, coding, analysis, and synthesis of the findings.

Table 21. Summary of Articles

Authors	Year	Title
Nilo Pena and Pinto Santos	2022	*A implementação de um sistema de gestão de aprendizagem (LMS) numa instituição de ensino superior angolana: uma revisão sistemática de literatura*
Kerimbayev et al.	2017	LMS Moodle: Distance international education in cooperation of higher education institutions of different countries
Luk et al.	2018	The Acceptance of Using Open-Source Learning Platform (Moodle) for Learning in Hong Kong's Higher Education
Geertshuis and Liu	2022	The challenges we face: A professional identity analysis of learning technology implementation
Cidral et al.	2018	E-learning success determinants: Brazilian empirical study
Kanchana and Sri Ranjini	2018	Investigation and study of vital factors in selection, implementation and satisfaction of ERP in small and medium scale industries

Authors	Year	Title
Lizarda et al.	2020	Virtual Learning Objects in the teaching of Financial Accounting II of the Accounting and Auditing Career at *Técnica del Norte* University
Monsalve-Pulido et al.	2022	Framework for the adaptation of an autonomous academic recommendation system as a service-oriented architecture
Narh et al.	2019	Virtual Platforms: Assessing the Challenges of E-Learning in Ghana
Singh et al.	2019	Implantation of an Open Source Moodle Platform across an Educational Institution
Hasnan and Mohin	2021	Implementation of LMS-CIDOS in Polytechnic English Language Classroom: Issues and Challenges
Antwi-Boampong and Bokolo	2021	Towards an Institutional Blended Learning Adoption Model for Higher Education Institutions
Kiegaldie et al.	2022	Implementation of a collaborative online international learning program in nursing education: protocol for a mixed methods study
Riemann et al.	2020	Agile Implementation of Virtual Reality in Learning Factories
Bordeleau et al.	2021	Digital Transformation Framework: Creating Sensing, Smart, Sustainable and Social (S^4) Organisations
Harfouche et al.	2018	A Framework for Artificial Knowledge Creation in Organizations
Ghnemat et al.	2022	Higher Education Transformation for Artificial Intelligence Revolution: Transformation Framework
Meacham et al.	2019	Framework for Personalised Online Education based on Learning Analytics through the use of Domain-Specific Modelling and Data Analytics
Chootongchai and Songkram	2018	Design and Development of SECI and Moodle Online Learning Systems to Enhance Thinking and Innovation Skills for Higher Education Learners
Meacham et al.	2020	AdaptiveVLE: An Integrated Framework for Personalized Online Education Using MPS JetBrains Domain-Specific Modeling Environment
Gupta et al.	2019	Design of Cyber-Human Frameworks for Immersive Learning
Wambsganss et al.	2021	Design and Evaluation of an Adaptive Empathy Learning Tool
Takács et al.	2021	Modular education framework supported by IT project management methods
Athauda et al.	2018	Design of a Technology-Enhanced Pedagogical Framework for a Systems and Networking Administration course incorporating a Virtual Laboratory
Smyrnova-Trybulska et al.	2022	Adaptive learning in university students' opinions: Cross-border research
Muammar et al.	2022	Evaluation of digital competence level among educators in UAE Higher Education Institutions using Digital Competence of Educators (DigComEdu) framework
Anabalón R.	2005	*Las Causas más Comunes de Falla en la Implantación de Mejoras en Software*
Díaz Piraquive et al.	2015	*Motivos de fracaso en los proyectos de Tecnologías de Información y Comunicaciones*
Ruiz and Meza Álvarez	2017	*Estructuración espectral de los fallos en implementación de sistemas ERP*
Kheybari et al.	2020	Evaluation of factors contributing to the failure of information systems in public universities: The case of Iran
Alhazmi and Rahman	2012	Why LMS failed to support student learning in higher education institutions
Ssekakubo et al.	2011	Issues of adoption: Have e-learning management systems fulfilled their potential in developing countries?

Table 22 presents a general synthesis of the main elements identified in the selected articles, aligned with the research questions. The summary groups the findings into three analytical categories: platforms, training campaigns, and frameworks. The percentages indicate the relative frequency with which each item appeared in the reviewed studies, allowing the identification of the most recurrent aspects associated with LMS implementation, use, and failure in higher education institutions.

Table 22. Summary of findings based on RQ

Analysis	Item	Percentage
Platforms	Moodle	43.75%
Platforms	Edx, latitude and others	56.25%
Training campaigns	Implementation processes, virtual learning environments, and use of emerging technologies	62.50%
Training campaigns	Study material, teacher-student interdependence, lack of quality, and others	37.50%
Frameworks	Humans	100.00%
Frameworks	Organizational culture	85.71%
Frameworks	Technological aspects	57.14%
Frameworks	Inappropriate content	42.85%

4 Discussion

The difference between this work and similar ones relates to its scope, since this research covers a broad process spanning from how an LMS is implemented to identifying the factors that determine its failure. In contrast, other works are limited to one or two of these topics, focusing only on implementation, on choosing a framework, or on identifying the reasons why these systems fail. This proposal offers a comprehensive answer that supports the successful implementation of LMS frameworks in HEIs. It is also important to note that most works on LMS in HEIs focus on implementation, whereas this work addresses LMS implementation more broadly.

After reviewing the bibliographic sources, it is evident that most of the articles refer to the use of emerging technologies and the implementation of courses with tools such as Moodle in higher education subjects, as well as collaborative work within and outside institutions, and even between different countries (Kiegaldie et al., 2022; Kerimbayev et al., 2017); there is a smaller number of investigations that focus on the implementation and the causes that lead to the failure of LMS in HEIs.

Virtual learning environments constitute the most frequent category in RQ01, with nine studies, followed by implementation processes with five and the use of emerging technologies with two, as shown in Figure 3.

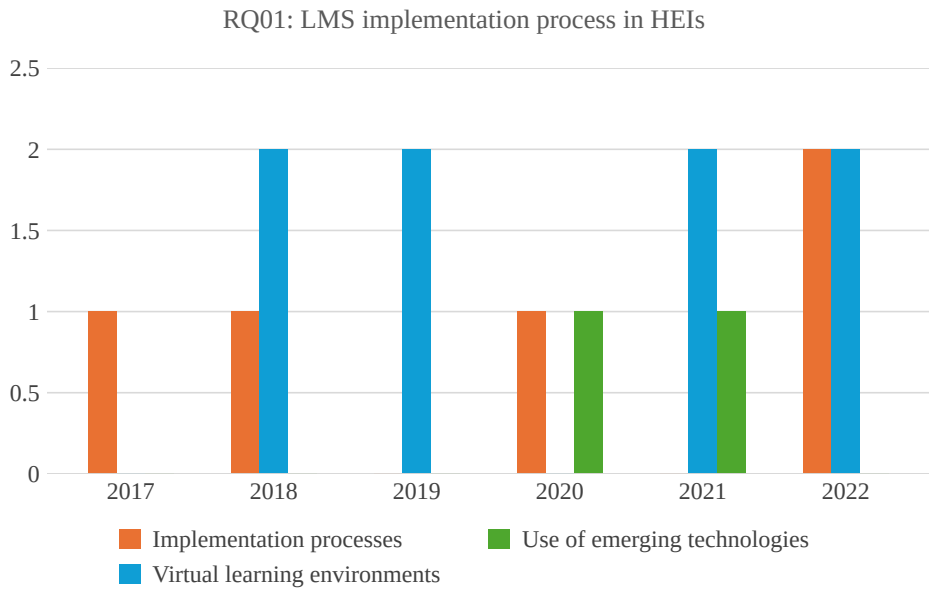


Figure 3. How is the process of implementing an LMS in HEIs carried out?

RQ02 comprises 11 unique studies and 12 category assignments: two address artificial intelligence, one addresses emerging tools in learning frameworks, and nine address frameworks for LMS applications; was coded in two categories. Frameworks for LMS applications therefore predominate and include adaptive, cyber-human, virtual-laboratory, project-management, and technology-enhanced learning approaches, as shown in Figure 4.

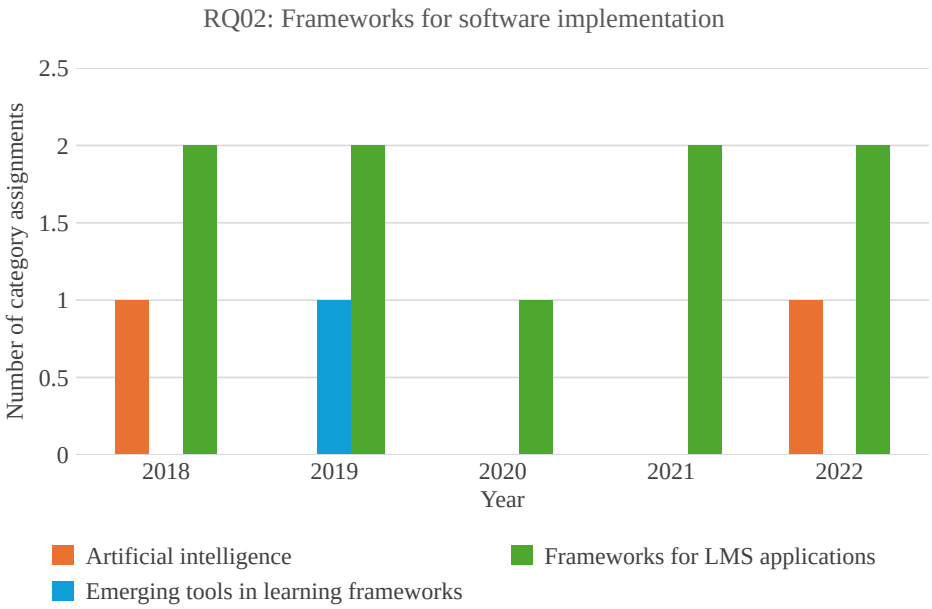


Figure 4. What are the frameworks for software implementation?

The seven studies associated with RQ03 were published in 2005, 2011, 2012, 2015, 2017, and 2020, as shown in Figure 5. Across these studies, human and organizational conditions recur as factors associated with the success or failure of LMS implementation.

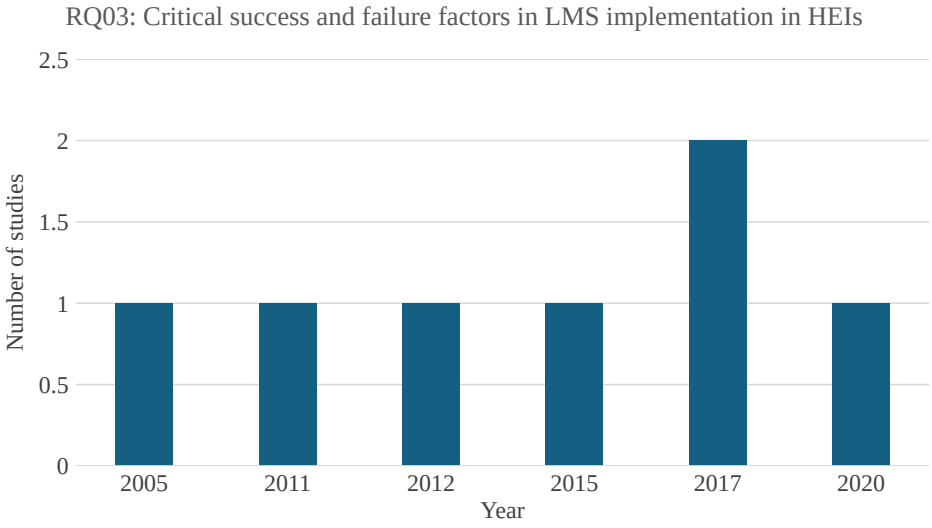


Figure 5. What are the critical success and failure factors in implementing an LMS in HEIs?

The data compiled in Table 23 enrich the analysis by showing that implementing an LMS in a university setting cannot be reduced to mere technological or operational issues. This systematic review confirms that multiple pedagogical, institutional, contextual, and sociocultural variables can undermine the expected benefits of the adopted LMS. Consequently, these results underscore the importance of understanding the proposed conceptual framework as an adaptable tool, sensitive to the specific characteristics of each environment, capable of guiding the implementation of the LMS while taking into account obstacles related to educator training, student engagement, digital access gaps, dependence on certain providers, and the required organizational maturity.

Table 23. Critical evidence on challenges and limitations of LMS implementation in higher education

Type of critical evidence	Study	Key finding	Relevance to LMS
LMS used solely as a file repository	Brady and O'Reilly (2020), on the impact of LMSs on academic work	The study found that faculty members primarily used the LMS as a repository for materials and to manage assessments, with little use of communication or monitoring features.	This type of evidence supports the argument that the mere availability of an LMS does not guarantee pedagogical transformation; the proposed framework must include actions focused on techno-pedagogical design, instructional planning, teacher training, and monitoring the pedagogical use of the platform.
Low student participation on virtual platforms	AlGhamdi and Bahaddad (2019), on the use of Blackboard at King Abdulaziz University	The study found that 78% of the students surveyed were inactive Blackboard users.	This evidence reinforces the need to incorporate strategies for teacher training, ongoing support, change management, and the active participation of teachers as key actors in the LMS implementation process.
Teacher resistance or low digital literacy	Ekuase-Anwansedo et al. (2018), on stakeholder analysis in LMS implementation	The authors note that understanding the needs of teachers, students, and other stakeholders is key to anticipating challenges and improving implementation success.	This evidence reinforces the need to incorporate strategies for teacher training, ongoing support, change management, and the active participation of teachers as key actors in the LMS implementation process.
Digital divide and unequal access	Ajani (2025), on students' experiences with LMS at a rural South African university	The study analyzes the infrastructural, sociocultural, and pedagogical challenges that hinder the effective adoption of LMSs in resource-limited settings.	This evidence shows that LMS implementation is influenced by socioeconomic, cultural, geographic, and infrastructural factors; the framework must account for accessibility, digital inclusion, and contextual adaptation, especially in the Global South.
Dependence on technology providers and platforms	de Andrade et al. (2023), on the growth of Educational Technology – EdTech platforms in HEIs	The study warns that dependence on platforms may be linked to privacy concerns, job insecurity, and the conversion of educational data into commercial assets.	This evidence offers a critical perspective on digital transformation, showing that the use of educational platforms can lead to technological dependence, data management risks, and subordination to business models. The framework must take into account governance, sustainability, security, institutional autonomy, and the critical evaluation of technology providers.

What emerges from a thorough analysis of the available literature is that implementing an LMS goes far beyond simply installing technology. The findings suggest that its pedagogical effectiveness rests on several pillars: a solid pedagogical design, genuine institutional support, adequate faculty training, meaningful student engagement, guarantees of accessibility, and sensitive adaptation to the specific characteristics of each context. In this regard, the framework presented here should be considered a flexible guide that takes local realities into account for deploying an LMS in higher education institutions.

4.1 Limitations

One of the most notable limitations of this study concerns the scope of the literature review. It is likely that the way the consulted databases were selected, along with the criteria for including or excluding studies, disproportionately favored research published in indexed journals, especially those available in English. As a result, significant work conducted in contexts where other languages are spoken, reports from local organizations, non-conventional sources of scientific information, and contributions from the Global South may have been overlooked. This issue takes on particular importance when considering that the adoption and implementation of LMSs are deeply influenced by multiple factors: the cultural context in which they are deployed, the linguistic characteristics of the region, local economic realities, the political landscape, and available infrastructure capabilities.

5 Conclusions

The systematic literature review shows that the successful implementation of LMS and other technology-mediated learning initiatives in higher education does not depend solely on the availability of technological infrastructure. The reviewed studies highlight the combined influence of institutional readiness, pedagogical planning, user acceptance, faculty training, stakeholder participation, technical support, digital competence, and continuous evaluation. They also reveal that limited infrastructure, resistance to change, insufficient engagement, and weak alignment between technology and educational needs can hinder implementation. Overall, the evidence supports a multidimensional and context-sensitive understanding of LMS implementation, in which technological, organizational, pedagogical, and human factors must be considered together. These findings provide the conceptual basis for structuring the proposed framework, whose practical application and empirical validation remain areas for future research.

Once the SLR was completed, the following conclusions were reached. When inquiring about how the implementation process for an LMS is carried out in HEIs, it is observed that Moodle is predominant, with 43.75%, and the remaining share is divided among EdX, Latitude, and other alternatives. In addition, the literature reviewed was split into three topics: implementation processes, virtual learning environments, and use of emerging technologies; more than 50% suggest focusing mainly on training campaigns to achieve a better attitude among teachers and students that favors the acceptance and good use of resources, although they also raise an alert regarding the overload of work this places on them. They also point to other factors, such as content quality and monitoring, as elements to be considered to avoid implementation failure. Regarding the use of emerging technologies, only 12.5% consider VR and DT.

Regarding software implementation frameworks, the 11 studies associated with RQ02 produced 12 category assignments: two related to artificial intelligence, one to emerging tools in learning frameworks, and nine to frameworks for LMS applications, in which the presentation of holistic, adaptive, VR-based cybernetic, and project management frameworks to create specific VLEs predominates, with some very complete frameworks showing positive impacts that improved thinking skills, and two of them intending to create a new language as future work.

As for the failure factors in the process of implementing an LMS in HEIs, 100% of the articles analyzed indicate that the human factor is a determining factor for the success or failure of this process, affecting both the users of the product, in terms of teachers' and students' attitudes and knowledge, and those responsible for the design, implementation, and deployment. Second, with 85.71% of the information referenced, another important factor is the HEI's organizational culture, since comprehensive support at the regulatory and policy levels is required for the adequate use of the developed systems. Other factors mentioned with lower percentages are technological aspects, with 57.14%, and the quality of the content included in the courses, with 42.85%.

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