Extending the DeLone and McLean Information Systems Success Model in Higher Education E-Learning: A Systematic Literature Review (2020–2025)

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ABSTRACT

This systematic literature review examines how the DeLone and McLean information systems success model (D&M ISSM) has been applied and extended in higher education e-learning research. Although established dimensions capture technological performance, system use and satisfaction, their relationship with instructional and learner-related constructs remains inconsistently specified. Guided by PRISMA 2020, the review reports searches of Scopus, ERIC, SAGE Journals and ProQuest covering 2020–2025. The source manuscript records 648 identified records, 638 after duplicate removal, 121 full-text assessments and 24 included records. Extracted evidence was synthesised thematically, with particular attention to instructor quality, learner quality and the model's established success dimensions. The synthesis indicates that pedagogical and learner-related variables can complement information, system and service quality, but their distinct explanatory contributions and measurement boundaries remain uncertain. The review clarifies the difference between established D&M ISSM constructs and proposed educational extensions and identifies priorities for theory-driven measurement and comparative research. The eligibility set, search dates and reported quality assessment must be verified before these findings can be considered definitive.

Keywords: DeLone and McLean model; information systems success; e-learning; higher education; systematic literature review.

1. Introduction

Digital learning environments now underpin course delivery, assessment, access to teaching materials and academic communication in higher education. Yet adoption or frequency of use alone does not establish that an e-learning platform improves the educational experience. Reliable infrastructure, relevant content, responsive support and demonstrable benefits must also be considered when evaluating success (Cidral et al., 2018; Sabeh et al., 2021; Al-Adwan et al., 2022). The DeLone and McLean information systems success model (D&M ISSM) provides a widely used basis for this evaluation. Its original formulation identified system quality, information quality, use, user satisfaction, individual impact and organisational impact (DeLone & McLean, 1992). The 2003 revision added service quality, addressed intention to use and actual use, and consolidated impacts

into net benefits (DeLone & McLean, 2003). Together, these dimensions connect information-system characteristics to users' experiences and outcomes.

The model has been refined through continuing debate about how quality, use and realised benefits should be conceptualised and measured. For example, service quality and the distinct roles of system use and perceived success have received particular attention (DeLone & McLean, 2003; Petter et al., 2013). An important implication is that successful deployment cannot be inferred from technical functioning in isolation. In higher education, the educational purpose of an e-learning platform adds complexity. Students may be required to access a system regardless of their satisfaction, while a positive interface experience does not necessarily imply better learning. Earlier research demonstrates the relevance of information and system quality but also suggests that instructional support, learner readiness and perceived usefulness help explain platform outcomes (Al-Fraihat et al., 2020; Sabeh et al., 2021; Hii et al., 2022).

The rapid expansion of online learning has intensified attention to the quality rather than merely the availability of learning systems (Al-Adwan et al., 2022). Accordingly, researchers have introduced pedagogical and learner-centred variables into D&M ISSM applications. Instructor quality may capture feedback, guidance and pedagogical competence; learner quality may incorporate preparation, motivation or the capability to learn digitally. However, these labels are not operationalised consistently, and some proposed extensions may overlap with established quality dimensions Recent scholarship has also called for a clearer account of the model's future evolution, including user experience and context-sensitive outcomes (Saba et al., 2025). The problem is therefore not simply whether additional variables predict e-learning success. It is whether their theoretical meanings, measurement choices and relationships to the original model are sufficiently distinct to justify extending the framework.

Existing applications provide evidence on individual relationships, but differences in populations, constructs and outcomes impede cumulative interpretation. A focused synthesis can distinguish core model components from contextual additions, show where reported relationships converge or differ, and identify what is still required to evaluate the incremental explanatory value of educational extensions. This review therefore aims to synthesise applications and proposed extensions of the D&M ISSM in higher education e-learning over the stated 2020–2025 period. Its intended contributions are to (a) clarify the conceptual status of the original and added constructs, (b) organise reported empirical relationships and (c) identify methodological priorities for testing extensions without conflating system performance, learner experience and educational benefit. Section 2 outlines the theoretical foundation; Section 3 describes the review procedures; Section 4 synthesises the reported evidence; and Sections 5 and 6 discuss implications, limitations and conclusions.

Table 1: Research objectives and corresponding questions

Objective	Research question
RO1. Examine original D&M ISSM dimensions	RQ1. How have original D&M ISSM dimensions been used to evaluate e-learning success in higher education?
RO2. Identify extended constructs	RQ2. Which pedagogical, technological and learner-related constructs have been added to the D&M ISSM?
RO3. Synthesise reported relationships	RQ3. What relationships are reported between established and extended constructs and e-learning outcomes?
RO4. Identify gaps and future directions	RQ4. What conceptual, theoretical and methodological gaps remain in these extensions?

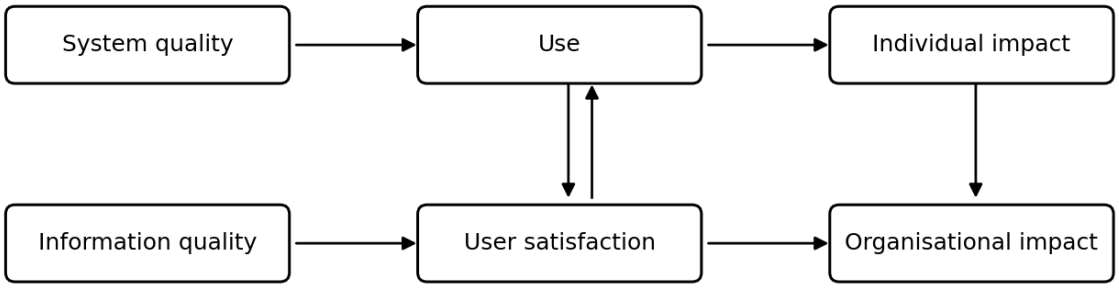
2. Theoretical framework

2.1 Original information systems success model

The original D&M ISSM proposes six interrelated dimensions rather than a single indicator of information-system success: system quality, information quality, use, user satisfaction, individual impact and organisational impact (DeLone & McLean, 1992). The model connects the quality of a system and its information to use and satisfaction and, ultimately, to benefits for individuals and organisations.

Figure 1

Schematic representation of the original D&M ISSM (1992)



Note. Simplified schematic redrawn for editorial clarity from the constructs discussed by DeLone and McLean (1992); arrows are illustrative and do not reproduce every path in the original model.

System quality concerns reliability, functionality, accessibility and technical performance. Information quality addresses the relevance, accuracy, completeness and comprehensibility of content. Use refers to engagement with the system, while user satisfaction captures the evaluation of that experience. Individual and organisational impacts refer to benefits realised at different levels (DeLone & McLean, 1992).

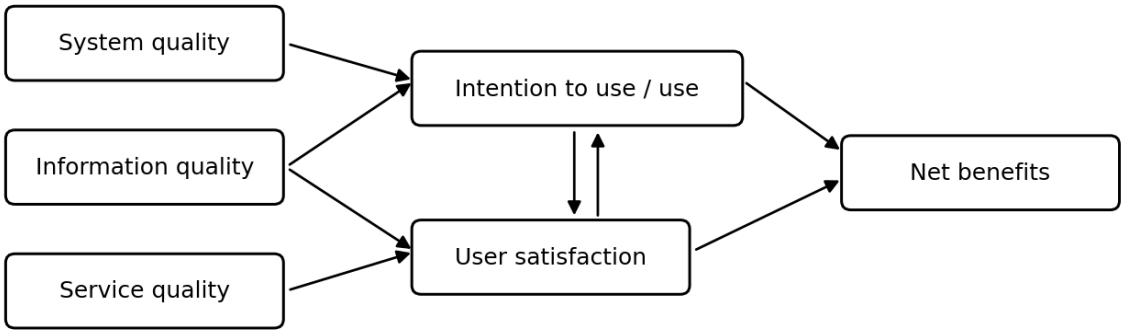
These distinctions matter in higher education. Compulsory use of a learning management system may be high even when students experience limited pedagogical value. Equally, satisfaction with convenience or interface design cannot substitute for demonstrated learning outcomes. The original model therefore encourages assessment of both user experiences and substantive benefits.

2.2 Updated model and the rationale for extensions

DeLone and McLean (2003) revised the model by formally incorporating service quality, distinguishing intention to use from actual use and replacing individual and organisational impacts with net benefits. The revision recognises that users' experience of support services and the benefits derived from technology may shape subsequent satisfaction and engagement.

Figure 2

Schematic representation of the updated D&M ISSM (2003)



Note. Simplified schematic redrawn from the key dimensions discussed by DeLone and McLean (2003).

The revised formulation identifies system quality, information quality and service quality as major antecedents of use and satisfaction. In e-learning, these dimensions represent system functioning, the quality of learning information and the support received by users. Use and satisfaction, in turn, relate to net benefits, which may include perceived learning value and institutional gains (DeLone & McLean, 2003). Educational applications often add instructor quality, learner quality, educational-system quality, support-system quality or perceived usefulness. Al-Fraihat et al. (2020), for example, examined technological and educational determinants in an integrated success framework. These additions offer potential explanatory value, but their boundaries must be defended: instructor quality is not automatically synonymous with service quality, and learner quality may encompass several different learner attributes. The analytical distinction guiding this review is therefore between established D&M ISSM dimensions and proposed educational extensions. Relationships reported in

individual studies are synthesised as associations within those studies; they are not treated as proof that every added construct has an independent, causal or generalisable effect.

3. Methodology

3.1 Review design and reporting guidance

The study was presented as a systematic literature review of empirical research on applications and extensions of the D&M ISSM in higher education e-learning. PRISMA 2020 was used as a reporting guide for identifying, screening and documenting included studies (Page et al., 2021). PRISMA is a reporting guideline and does not, by itself, establish the methodological quality of a review. The review protocol or registration status was not provided in the source manuscript. The source manuscript also states that EndNote was used for reference management, Rayyan for screening, EPPI-Reviewer for data extraction and quality-assessment support, and NVivo for qualitative coding. Specific software versions, screening procedures, independent-reviewer arrangements and decisions on disagreements were not reported and should be supplied by the authors.

3.2 Information sources, search period and strategy

Four sources were reported: Scopus, ERIC, SAGE Journals and ProQuest. They were selected to cover information systems, digital learning and higher education. The stated publication window was 2020–2025, but the manuscript describes searches undertaken in January 2025. A search conducted then cannot capture publications from the remainder of 2025 unless a later update was completed. The authors must confirm each final search date and whether the searches were rerun.

Table 2: Search strings as reported by the authors

Source	Reported Boolean search strategy
ERIC	("DeLone and McLean" OR "information systems success model" OR "IS success model") AND ("e-learning" OR "online learning" OR "learning management system" OR "digital learning") AND ("higher education" OR university OR "tertiary education")
Scopus	TITLE-ABS-KEY (("DeLone and McLean" OR "D&M model" OR "information systems success model") AND ("e-learning" OR "online learning" OR "learning management system*" OR "digital learning") AND ("higher education" OR university OR "tertiary education"))
SAGE	("DeLone and McLean" OR "information systems success model" OR "IS success model") AND ("e-learning" OR "online learning" OR "learning management system") AND ("higher education" OR university OR universities)

Source	Reported Boolean search strategy
ProQuest	AB (("DeLone and McLean" OR "information systems success model" OR "IS success model") AND ("e-learning" OR "online learning" OR "learning management system*" OR "digital learning") AND ("higher education" OR university OR "tertiary education"))

3.3 Eligibility criteria

The reported criteria limited inclusion to English-language journal articles on higher education, education management or educational technology published from 2020 to 2025. Books, book chapters, conference publications and studies outside higher education were stated to be excluded. The authors should specify the required use of the D&M ISSM, acceptable study designs and whether purely conceptual papers were eligible.

Table 3: Reported inclusion and exclusion criteria

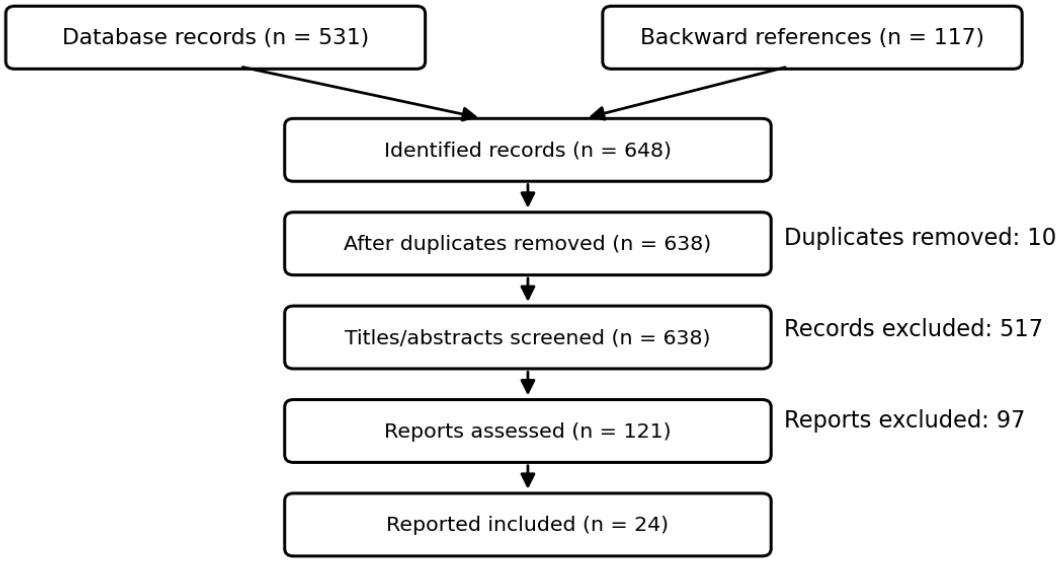
Criterion	Inclusion	Exclusion
Language	English	Languages other than English
Publication type	Peer-reviewed journal articles	Books, chapters, reports and conference papers
Educational setting	Higher education	Settings outside higher education
Publication period	2020–2025	Outside 2020–2025
Topical relevance	Education management and educational technology involving D&M ISSM	Outside the stated education and information-systems scope

3.4 Identification, screening and eligibility

The manuscript reports 531 database records and a further 117 identified through backward citation searching, giving 648 records. Following removal of 10 duplicates, 638 records remained for title and abstract screening. Of these, 517 were excluded and 121 records underwent eligibility assessment. The source reports 97 further exclusions and 24 included records. These figures are arithmetically consistent, but the final eligibility list contains repetitions and records apparently outside the predefined scope; consequently, the number of unique, eligible studies has not yet been independently established.

Figure 3

Reconstructed flow of study selection using reported counts



Note. This figure reconstructs the counts supplied in the source manuscript rather than validating the underlying screening log. Reasons for all 97 full-text exclusions and reconciled unique-study counts are still required.

3.5 Characteristics of studies reported as eligible

Table 4 reproduces the study-identification information supplied by the authors, with obvious spelling normalised and independently confirmed publication-year corrections annotated. It should not yet be interpreted as a verified set of 24 distinct eligible publications. At least two entries appear to repeat the same study; several other entries concern non-educational applications or publication dates outside the specified period.

Table 4: Studies listed as eligible in the submitted manuscript

Study as reported	Year	Setting	Reported focus
Pham et al. [date check]	2019*	Vietnam	E-learning service quality, student satisfaction and loyalty
Alotaibi & Roussinov	2020	Saudi Arabia	User acceptance of mobile learning;
Brady & O'Reilly	2020	Not reported	Learning management systems and academic work
Al-Fraihat et al	2020	United Kingdom	Instructor quality, learner quality, educational system quality, support system quality and perceived usefulness

Study as reported	Year	Setting	Reported focus
Chaudhry et al.	2021	United Arab Emirates	Success of real-time online learning delivery during COVID-19
Shahzad et al.	2021	Not reported	E-learning adoption and system quality during COVID-19
Islam [date check]	2016*	Not reported	Perceived compatibility as a moderator of system use and outcomes
Mohammadi et al.	2021	Afghanistan	Factors and challenges affecting LMS use during COVID
Al-Azawei & Al-Azawi [scope check]	2021	Iraq	Evaluating Facebook success in Iraq: An extension of the DeLone and McLean's model of information systems success
Al-Adwan et al.	2022	Jordan	Towards a Sustainable Adoption of E-Learning Systems: The Role of Self-Directed Learning.
Alotaibi & Alshahrani	2022	Saudi Arabia	Instructor quality, learner quality and perceived usefulness
Rokhman et al.	2022	Indonesia	Teacher capability, student capability and social influence
Jami Pour et al.	2022	Republic of Iran	User type as a moderator in D&M e-learning success relationships
Alotaibi & Alshahrani [possible duplicate]	2022	Saudi Arabia	instructor quality, learner quality and perceived usefulness
Zhang and Mangmeechai	2022	Not reported	Highlighted the adaptability of the D&M framework to different technological and organizational environments
Mpungose and Khoza	2022	South Africa	Postgraduate students' experiences on the use of Moodle and Canvas learning management system
Teng, Tan, and Ehsani	2022	Not reported	Cloud-based e-learning during COVID-19
Dangaiso et al.	2023	Zimbabwe	Instructor quality and e-learning continuance intentions
Al-Okaily et al. [scope check]	2023	Jordan	Blockchain technology in accounting systems;
Alyoussef	2023	Saudi Arabia	The Role of Task-Technology Fit with the Information Systems Success Model
Alduaij et al.	2024	Kuwait	Instructor quality, learner quality and education quality
Atukunda et al.	2024	Uganda	Instructor quality, course quality and perceived usefulness

Study as reported	Year	Setting	Reported focus
Dube and Humbani [scope check]	2024	South Africa	psychological considerations relevant to mobile application use.
Atukunda et al. [possible duplicate]	2024	Uganda	Instructor quality, course quality and perceived usefulness

Note. *Publication year independently verified: Pham et al. (2019) and Islam (2016) fall outside the stated period. Flags identify potential eligibility and duplicate issues; the source dataset must be reconciled before submission.

3.6 Data extraction, quality appraisal and synthesis

The authors report extracting publication year, country, study context, methods, model constructs and principal findings and applying qualitative thematic synthesis. The narrative organises results around instructional and learner-related extensions, established quality dimensions and outcomes. It is not clear whether themes were generated inductively, deductively from D&M ISSM, or through a combined approach. The coding units, number of codes, reconciliation steps and thematic evidence matrix should be reported to make the synthesis reproducible. Although the original abstract names the QualSyst instrument, the methodology provides no scoring rubric, reviewer-level scores, thresholds or decision rules. Accordingly, this edited manuscript does not claim that a completed critical appraisal has been demonstrated. Any quality-weighted interpretation should be deferred until the authors provide the appraisal records and explain how study quality affected synthesis. This review analysed published documents and did not involve recruitment of human participants or access to identifiable participant-level records. Institutional ethics approval and individual informed consent were therefore not sought. The authors should confirm that this statement conforms to their institutional and journal requirements.

4. Results and synthesis

The reviewed material indicates that researchers have retained D&M ISSM quality, use, satisfaction and benefit dimensions while introducing context-specific factors. The strongest educational additions in the reported synthesis are instructor-related and learner-related constructs. Given the unresolved eligibility list and the lack of a study-by-study evidence matrix, the results below describe patterns in the submitted narrative rather than verified effect-size estimates or pooled causal conclusions.

4.1 Core D&M ISSM dimensions in e-learning

System quality, information quality and service quality remain pertinent because e-learning depends on usable platforms, meaningful educational content and timely assistance. System use and user

satisfaction are distinct outcomes and should not be treated as interchangeable measures of success; educational net benefits need their own indicators. These distinctions are especially relevant when institutional use of a platform is compulsory (DeLone & McLean, 2003; Al-Fraihat et al., 2020; Sabeh et al., 2021).

4.2 Instructor quality as a pedagogical extension

Instructor quality is a prominent educational extension. Al-Fraihat et al. (2020) considered instructor-related quality alongside technical and learner factors. Alotaibi and Alshahrani (2022) incorporated instructor quality, learner quality and perceived usefulness, while Dangaiso et al. (2023), Alduaij et al. (2024) and Atukunda et al. (2024) considered related aspects of teaching support in university e-learning contexts. Across these applications, instructor quality directs attention to guidance, feedback, competence and pedagogical support. It should nevertheless be defined and assessed separately from support-service quality. The available narrative does not show that its incremental contribution was consistently tested after controlling for established D&M ISSM dimensions.

4.3 Learner quality, capability and preparedness

Learner quality is also presented as an extension, particularly in studies that combine educational and technological characteristics (Al-Fraihat et al., 2020; Alotaibi & Alshahrani, 2022). The manuscript further attributes relationships involving perceived ease of use, usefulness and satisfaction to Alduaij et al. (2024). These reports suggest that learner characteristics may condition experiences of the same platform. The concept remains insufficiently bounded. Learner quality can refer to preparedness, self-regulation, digital competence or attitudes, which may have distinct theoretical functions. Rokhman et al. (2022) examined teacher and student capabilities and social influence, reporting relationships with satisfaction but not with system use. Differences of this kind warrant explicit construct definitions and careful distinction between predictors, moderators, mediators and outcomes.

4.4 Alignment of technological capabilities and educational tasks

Alyoussef (2023) combined task–technology fit with D&M ISSM constructs in a higher education setting. This approach draws attention to the correspondence between what a platform supports and what students are expected to accomplish. It illustrates why technical quality alone may not be sufficient for educational benefit: the system must also support the learning tasks for which it is deployed.

4.5 Contextual extensions and questions of scope

The supplied tables additionally list applications concerning Facebook, banking information systems and mobile travel services. Such studies may provide broader theoretical context for D&M ISSM

adaptability, but they do not meet the stated eligibility criterion of higher education e-learning without an explicit justification. They should therefore be treated as background examples, not counted as eligible higher-education evidence, unless the authors revise and consistently apply their review question and inclusion protocol.

4.6 Synthesis of relationships and evidence gaps

The evidence as currently reported supports a conceptual distinction between foundational quality, use, satisfaction and benefit dimensions and potential educational extensions such as instructor quality, learner quality, teacher capability and student capability. However, the text does not provide a complete matrix of hypotheses, coefficients, significance, sampling design or quality appraisal for each included study. It would therefore be premature to state how many extensions have independent empirical support or which extension performs best across contexts.

Table 5: Analytical classification of established and proposed constructs

Construct group	Representative constructs	Role in a defensible extended model
Original/updated D&M ISSM	System quality; information quality; service quality; use/intention to use; user satisfaction; net benefits	Retain as core dimensions; specify expected direction of relationships
Instruction-related extensions	Instructor quality; teacher capability; course quality	Define pedagogical support clearly and test distinction from service and information quality
Learner-related extensions	Learner quality; student capability; self-directed learning	Specify whether characteristics are antecedents, moderators or mediators
Task/context-related extensions	Task–technology fit; perceived usefulness	Justify theoretical integration and avoid duplicating established outcomes

Note. This classification is an interpretive synthesis of the manuscript, not a meta-analysis or a count of independently validated effects.

5. Discussion

The D&M ISSM continues to offer a coherent vocabulary for assessing information systems success in higher education. Its principal value lies in separating technical and informational characteristics from use, satisfaction and net benefits. Applying the framework to e-learning introduces a legitimate question: what explanatory value is added when the actors and pedagogical processes of teaching and learning are explicitly modelled? Instructor quality and learner quality are plausible educational extensions, but conceptual plausibility is not equivalent to empirical distinctiveness. Instructor feedback may be measured as part of service quality in one study and as instructor quality in another. Learner quality may be operationalised through capability, motivation or readiness. Unless measures

are explicitly compared, findings using the same label may not be commensurable and findings using different labels may reflect overlapping phenomena. The synthesis thus supports a theory-building rather than a variable-accumulation approach. Future extended models should explain why an additional construct sits outside the original framework, how it relates to established dimensions and what improvement in explanation it is expected to provide. Longitudinal or comparative designs could further distinguish platform use from learning gains and identify whether proposed effects hold in different institutional settings.

5.1 Theoretical contributions

First, the review clarifies the separation between the six dimensions of the updated D&M ISSM and educational constructs proposed as additions. Second, it identifies construct overlap as a central challenge in cumulative research on e-learning success. Third, it articulates the need to test incremental explanatory value and net educational benefits, rather than interpreting higher usage or satisfaction as complete evidence of learning success.

5.2 Practical and policy implications

Higher education institutions should evaluate digital learning through a balanced set of technical, informational, service and pedagogical indicators. Decisions on platform improvement should draw on evidence about instructional support, learner readiness and realised educational outcomes rather than system usage alone. For policymakers, the framework offers a way to connect infrastructure investments with teaching quality and equitable support for diverse learners.

5.3 Limitations and necessary validation

The findings are subject to the scope and transparency of the underlying search and eligibility procedures. The submitted record list includes apparent duplicate items, publications outside the stated timeframe and applications beyond higher education. Full search dates, the deduplicated corpus, reasons for full-text exclusion and critical-appraisal results are unavailable. Therefore, this revised synthesis should be treated as provisional until those issues are resolved and the included-study table and PRISMA totals are reconciled.

6. Conclusion

This review examines how the DeLone and McLean information systems success model has been used and extended to understand higher education e-learning. The submitted evidence suggests that established quality, use, satisfaction and net-benefit dimensions remain central while instructor quality, learner quality and related capabilities merit theoretical consideration. The major research priority is to demonstrate that educational additions are clearly defined, non-redundant and

empirically useful. Resolving the documented eligibility, search-date and citation issues is essential before the review can provide a reproducible foundation for publication.

References

Al-Adwan, A. S., Nofal, M., Akram, H., Albelbisi, N. A., & Al-Okaily, M. (2022). Towards a sustainable adoption of e-learning systems: The role of self-directed learning. *Journal of Information Technology Education: Research*, *21*, 245–267. https://doi.org/10.28945/4980

Al-Azawei, A., & Al-Azawi, R. (2021). Evaluating Facebook success in Iraq: An extension of the DeLone and McLean's model of information systems success. *Journal of Physics: Conference Series*, *1804*(1), 012114. https://doi.org/10.1088/1742-6596/1804/1/012114

Al-Fraihat, D., Joy, M., Masa'deh, R., & Sinclair, J. (2020). Evaluating e-learning systems success: An empirical study. *Computers in Human Behavior*, *102*, 67–86. https://doi.org/10.1016/j.chb.2019.08.004

Al-Okaily, M., Al-Majali, D., Al-Okaily, A., & Majali, T. E. (2023). Blockchain technology and its applications in digital accounting systems: Insights from the Jordanian context. *Journal of Financial Reporting and Accounting*. [Publication details require verification]

Alduaij, M. Y., Alterkait, M. A., & Alainati, S. (2024). Using the DeLone and McLean success model to evaluate Moodle's information system success. *Engineering, Technology & Applied Science Research*, *14*(4), 15008–15015. https://doi.org/10.48084/etasr.7300

Alotaibi, M., & Roussinov, D. (2020). User acceptance of m-learning: An empirical investigation in Saudi Arabia. *Computers & Education*, *144*, 103693. https://doi.org/10.1016/j.compedu.2019.103693

Alotaibi, R. S., & Alshahrani, S. M. (2022). An extended DeLone and McLean's model to determine the success factors of e-learning platform. *PeerJ Computer Science*, *8*, e876. https://doi.org/10.7717/peerj-cs.876

Alyoussef, I. Y. (2023). Acceptance of e-learning in higher education: The role of task–technology fit with the information systems success model. *Heliyon*, *9*(3), e13751. https://doi.org/10.1016/j.heliyon.2023.e13751

Atukunda, P., Khabusi, S. P., & Othieno, J. (2024). Analysis of user satisfaction of e-learning systems in Uganda using DeLone and McLean model. *Discover Education*, *3*, Article 194. https://doi.org/10.1007/s44217-024-00304-6

Brady, M., & O'Reilly, N. (2020). Learning management systems and their impact on academic work. *Technology, Pedagogy and Education*, *29*(3), 251–268. https://doi.org/10.1080/1475939X.2020.1743746

Chaudhry, I. S., Paquibut, R. Y., Islam, A. K. M. N., & Chabchoub, H. (2021). Testing the success of real-time online delivery channel adopted by higher education institutions in the United Arab Emirates during the COVID-19 pandemic. *International Journal of Educational Technology in Higher Education*, *18*, Article 42. https://doi.org/10.1186/s41239-021-00283-w

Cidral, W., Oliveira, T., Di Felice, M., & Aparício, M. (2018). E-learning success determinants: Brazilian empirical study. *Computers & Education*, *122*, 273–290. https://doi.org/10.1016/j.compedu.2017.12.001

Dangaiso, P., Makudza, F., Jaravaza, D. C., Kusvabadika, J., Makiwa, N., & Gwatinyanya, C. (2023). Evaluating the impact of quality antecedents on university students' e-learning continuance intentions: A post-COVID-19 perspective. *Cogent Education*, *10*(1), 2222654. https://doi.org/10.1080/2331186X.2023.2222654

DeLone, W. H., & McLean, E. R. (1992). Information systems success: The quest for the dependent variable. *Information Systems Research*, *3*(1), 60–95. https://doi.org/10.1287/isre.3.1.60

DeLone, W. H., & McLean, E. R. (2003). The DeLone and McLean model of information systems success: A ten-year update. *Journal of Management Information Systems*, *19*(4), 9–30. https://doi.org/10.1080/07421222.2003.11045748

Dube, N., & Humbani, M. (2024). Testing a modified information system success model in a mobile travel app context. *The Electronic Journal of Information Systems in Developing Countries*, *90*(6), e12339. https://doi.org/10.1002/isd2.12339

Hii, P. K., Goh, C. F., Rasli, A., & Tan, O. K. (2022). A review of two decades of research on the application of multicriteria decision making techniques to evaluate e-learning's effectiveness. *Knowledge Management & E-Learning*, *14*(4), 466–488. https://doi.org/10.34105/j.kmel.2022.14.024

Islam, A. K. M. N. (2016). E-learning system use and its outcomes: Moderating role of perceived compatibility. *Telematics and Informatics*, *33*(1), 48–55. https://doi.org/10.1016/j.tele.2015.06.010

Mohammadi, M. K., Mohibbi, A. A., & Hedayati, M. H. (2021). Investigating the challenges and factors influencing the use of the learning management system during the COVID-19 pandemic in Afghanistan. *Education and Information Technologies*, *26*(5), 5165–5198. https://doi.org/10.1007/s10639-021-10517-z

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., . . . Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, *372*, n71. https://doi.org/10.1136/bmj.n71

Petter, S., DeLone, W., & McLean, E. R. (2013). Information systems success: The quest for the independent variables. *Journal of Management Information Systems*, *29*(4), 7–62. https://doi.org/10.2753/MIS0742-1222290401

Pham, L., Limbu, Y. B., Bui, T. K., Nguyen, H. T., & Pham, H. T. (2019). Does e-learning service quality influence e-learning student satisfaction and loyalty? Evidence from Vietnam. *International Journal of Educational Technology in Higher Education*, *16*, Article 7. https://doi.org/10.1186/s41239-019-0136-3

Rokhman, F., Mukhibad, H., Hapsoro, B. B., & Nurkhin, A. (2022). E-learning evaluation during the COVID-19 pandemic era based on the updated DeLone and McLean information systems success model. *Cogent Education*, *9*(1), 2093490. https://doi.org/10.1080/2331186X.2022.2093490

Saba, P., DeLone, W., Ul-Ain, N., Harfouche, A., Ben Nasr, I., Biot-Paquerot, G., & Mallek, S. (2025). The DeLone and McLean information systems success model: What is the future evolution for its foundations, components, and applications? *Communications of the Association for Information Systems*, *57*, 878–898. https://doi.org/10.17705/1CAIS.05738

Sabeh, H. N., Husin, M. H., Kee, D. M. H., Baharudin, A. S., & Abdullah, R. (2021). A systematic review of the DeLone and McLean model of information systems success in an e-learning context (2010–2020). *IEEE Access*, *9*, 81210–81235. https://doi.org/10.1109/ACCESS.2021.3084815

Shahzad, A., Hassan, R., Abdullah, N. I., Hussain, A., & Fareed, M. (2021). COVID-19 impact on e-learning adoption and system quality. *Sustainability*, *13*(3), 1540. https://doi.org/10.3390/su13031540