Critical Success Factors and Barriers in the Implementation of E-learning in Higher Education: A Literature Review

Analysing Key Factors, Barriers, and Best Practice in the Digital Transformation of Higher Education

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1 Introduction

This literature review addresses the transformation of higher education through digital learning technologies, examining both critical success factors and barriers to successful implementation. The following sections establish the research scope and contextual foundations before synthesising evidence from recent scholarship.

1.1 Focus and Aim of Review

The review seeks to synthesise multidisciplinary evidence from technological, pedagogical, institutional, and policy perspectives. The target audience includes educators, institutional policymakers, researchers, and digital learning practitioners interested in improving e-learning strategies and outcomes.

The guiding research question for this review is:
What are the critical success factors and main barriers influencing the effective implementation of e-learning in higher education institutions?

1.2 Significance of Review

This review addresses the urgent need to understand e-learning dynamics in the wake of rapid digital transformation accelerated by recent global events such as the COVID-19 pandemic. It is significant for guiding institutions in optimising investments, enhancing learner engagement, reducing disparities, and designing resilient e-learning ecosystems.

2   Context, Perspective, and Theoretical Framework

This section outlines the theoretical foundations and methodological approach employed in synthesising the literature.

2.1   Context of the Topic

Implementation of e-learning within higher education institutions, a field undergoing rapid digital transformation globally, is centered. The review adopts a pragmatic perspective aimed at synthesising empirical findings across technological, pedagogical, and institutional factors, without employing overly complex theoretical models.

2.2   Perspective and Framework

To guide the synthesis, a simplified framework combining key dimensions from established models is used: technological readiness, institutional support, learner engagement, and policy environment. A PRISMA-inspired methodology ensures systematic identification and selection of literature, enabling consistent analytical standards across diverse studies.

2.3   Methodology for Literature Selection

The literature review draws upon scholarly articles sourced from four key academic databases: the University of Essex Online (UoEO) library, Scopus, IEEE Xplore, and Google Scholar.

Key search terms used to locate relevant literature are e-learning implementation, online learning adoption, digital education, and technology enhanced learning. These terms were combined with higher education, university, college as well as barriers, challenges and obstacles. This method facilitates a robust and focused collection of scholarly articles suitable for comprehensive synthesis. Actual search terms were formatted as follows:

- ("e-learning implementation" OR "online learning adoption") AND ("higher education" OR "university" OR "college")
- ("digital education" OR "technology enhanced learning") AND ("barriers" OR "challenges" OR "obstacles") AND ("higher education")

To ensure the relevance and quality of the sources, only peer-reviewed articles in English, published within the last five years have been considered. Additionally, emphasis was placed on selecting articles that have been cited by other reputable sources, reflecting their influence and acceptance within the academic community. This approach aids in capturing both current and impactful research on e-learning implementation in higher education, conducive to a robust and credible synthesis.

2.4 Analytical Approach

This review employs thematic analysis structured around the dimensional framework (technological, pedagogical, institutional, policy). Findings were coded into success factors and barriers, organised by dimension.

2.5 Structure of Review

This literature review is organised into three main sections:

- Section 1 identifies the main findings from the selected literature.
- Section 2 identifies the critical success factors of the implementation of e-learning in higher education institutions.
- Section 3 identifies main barriers.

3 Main findings from the Literature

E-learning has transformed higher education, accelerated by COVID-19 which necessitated rapid institutional adaptation (Turnbull, Chugh and Luck, 2021). In an Australian review including 26 studies from universities around the world, Turnbull, Chugh and Luck (2021) document emergency transitions wherein institutions pivoted to online delivery within weeks, revealing significant barriers related to instructor preparedness and technological infrastructure. Singh, Singh and Mishra's (2024)

systematic review demonstrates that technology-enhanced learning provides flexibility and accessibility, though effectiveness varies significantly across socio-economic contexts.

Crucially, effectiveness depends upon complex interactions amongst technological infrastructure, pedagogical design, institutional support and learner characteristics (Yodihartomo, Aurelia H. and Wijaya, 2022; Weerapperuma, Nawinna and Gamage, 2024; Huang *et al.*, 2025). Yodihartomo, Aurelia H. and Wijaya's (2022, p. 519) Indonesian analysis conceptualises e-learning as enabling study "from anywhere and anytime", yet identifies seven interdependent success factors (system quality, internet quality, information quality, learner, instructor, content and institution's support) requiring simultaneous attention. Weerapperuma, Nawinna and Gamage's (2024) social capital analysis of Sri Lankan tertiary education reveals that structural, relational and cognitive factors collectively influence digital learning effectiveness. Huang *et al.* (2025) conducted a systematic review of 94 studies on AI implementations across Chinese universities and identified the Cognitive Evolution Engine (CEE) as an adaptive AI system offering significant potential for personalised learning through dynamic cognitive modelling, evolutionary algorithms, and real-time adaptation to individual learner needs among China's 47.6 million higher education students, although substantial gaps persist between theoretical concepts and practical deployment. These findings suggest successful implementation requires holistic institutional strategies addressing technological, pedagogical and organisational factors simultaneously rather than treating technology as standalone solutions (Amrane-Cooper *et al.*, 2023).

Building on these foundational insights, the literature reveals specific success factors that enable institutions to navigate the complex technological, pedagogical, and organisational landscape. The following section synthesises these enabling conditions into seven interrelated domains, grounded in empirical findings from diverse institutional contexts.

3.1 Critical Success Factors

Astuti and Yusdita's (2024) study found that system quality, comprising adaptation capabilities, availability, reliability, and response time, significantly influenced user satisfaction, accounting for 69.4 per cent of variance. The findings highlight the primacy of technical infrastructure, indicating institutions should prioritise platform reliability audits.

Weerapperuma, Nawinna and Gamage's (2024) highlight that internet quality and infrastructure represent critical enablers. Their study includes 164 responses from students in Sri Lanka and reveals that connectivity disruptions and limited device availability create substantial access barriers. Their structural equation modelling demonstrates infrastructure quality directly predicts social capital formation, with rural students facing disproportionate disadvantages exacerbating inequalities. Institutions must prioritise infrastructure investment (minimum 30% of digital learning budget) alongside content development, targeting rural connectivity and device loan programs for disadvantaged students.

Learner characteristics and readiness significantly determine outcomes (Astuti and Yusdita, 2024). Astuti and Yusdita's (2024) findings reveal prior technical experience, digital literacy and self-regulated learning capabilities prove particularly influential, supporting structured digital literacy programmes tailored to diverse readiness levels.

Instructor competence constitutes another critical success factor (Purwandari *et al.*, 2024). Purwandari *et al.*'s (2024) investigation of 180 Indonesian lecturers at private universities reveals personal innovativeness and computer self-efficacy significantly predict adoption intentions, finding innovative lecturers 70.2% more likely to perceive e-learning as easy to use. Hence they suggest comprehensive professional development programmes targeting online pedagogy.

Institutional support mechanisms encompass technical assistance and dedicated enhancement teams (Achtypi *et al.*, 2025). Achtypi *et al.*'s (2025) UK qualitative study demonstrates specialist support for students with specific learning differences proves

essential, with participants reporting greater difficulties accessing support remotely. Strategic resource allocation towards support services emerges as crucial.

Content quality and pedagogical design significantly influence outcomes (Turnbull, Chugh and Luck, 2021). Turnbull, Chugh and Luck (2021) emphasise purposeful instructional design, with students preferring purpose-designed online materials over simply recorded lectures.

Social capital is a foundational factor, significantly influencing the digital learning issues experienced by tertiary students; its three major dimensions structural, cognitive, and relational account for an 83.3% variance in Weerapperuma, Nawinna and Gamage's (2024) findings. This influence operates through the development of network connectivity, trust relationships, and shared cognitive frameworks, which collectively facilitate knowledge exchange (Weerapperuma, Nawinna and Gamage, 2024). Consequently, institutions should actively foster e-learning communities via structured collaboration programmes.

3.2 Main Barriers

Significant barriers frequently preclude operationalisation of these success factors. These operate across the same four dimensions but warrant distinct examination. This review uses 'barriers' to denote structural obstacles and 'challenges' to indicate difficulties requiring adoption.

Technological barriers remain pervasive (Turnbull, Chugh and Luck, 2021; Weerapperuma, Nawinna and Gamage, 2024; Okur *et al.*, 2025). Turnbull, Chugh and Luck (2021) report access barriers including unreliable connectivity, limited devices and compatibility issues. Weerapperuma, Nawinna and Gamage's (2024) Sri Lankan research reveals connectivity disruptions and device shortages as substantial barriers, with infrastructure quality directly predicting effectiveness. Okur *et al.'s* (2025) European study reveals institutions struggle balancing digitisation pressures with strategic planning. Institutions can mitigate technological barriers through:

a) Phased infrastructure investment prioritising connectivity over software (Weerapperuma, Nawinna and Gamage, 2024).

b) Flexibility in asynchronous course delivery for students with connectivity issues (Turnbull, Chugh and Luck, 2021).

c) Prioritise system quality improvements (Astuti and Yusdita, 2024).

This three-pronged approach directly addresses the Sri Lankan evidence showing infrastructure quality predicts social capital formation.

While technological barriers are foundational, pedagogical barriers present equally significant obstacles, as infrastructure alone cannot ensure effective learning outcomes. Turnbull, Chugh and Luck (2021) reveal academics reporting insufficient preparation time and engagement concerns, with barriers in assessment integrity. Mulaudzi (2024, p. 3456) surveyed 10 educators in a university in South Africa and found that "50% identified insufficient professional development opportunities as a critical challenge". Yodihartomo, Aurelia H. and Wijaya (2022) identify pedagogical preparation gaps as significant barriers. Mitigation strategies should mandate training, establish peer mentoring and provide instructional design support.

Social isolation affects wellbeing and engagement (Weerapperuma, Nawinna and Gamage, 2024; Achtypi *et al.*, 2025). Achtypi *et al.* (2025) report prolonged screen time and reduced connection negatively impact motivation and belonging, with students with learning differences indicating decreased interaction hindered learning. Weerapperuma, Nawinna and Gamage's (2024) demonstrates social capital factors collectively influence effectiveness. Institutions should implement 2-3 weekly synchronous sessions per course (e.g., Tuesday 10am, Thursday 3pm) complemented by asynchronous forums; virtual social spaces could include Discord/Teams channels where students self-organise study groups.

Deficiencies in digital competence affect both students and academic staff within higher education institutions (Yodihartomo, Aurelia H. and Wijaya, 2022; Zhang, 2025). Yodihartomo, Aurelia H. and Wijaya (2022) identify insufficient literacy and varying self-efficacy as barriers. Zhang (2025) concludes computer self-efficacy and experience significantly predict adoption. Turnbull, Chugh and Luck (2021) demonstrate competence extends beyond technical skills to information literacy, with students reporting difficulties evaluating source credibility. This necessitates comprehensive digital literacy frameworks through tiered training programmes.

Equity concerns pervade e-learning environments, with students having learning differences or disadvantaged backgrounds facing particular barriers (Achtypi *et al.*, 2025). E-learning can exacerbate inequalities when institutional contexts fail addressing diverse needs, requiring proactive universal design implementation.

Institutional capacity limitations constrain implementation (Okur *et al.*, 2025; Zhang, 2025). Zhang (2025) reports institutions balance competing priorities whilst managing resource constraints. Okur *et al.* (2025) document long procurement cycles, dependence on external providers and economic considerations dominating selection. This suggests collaborative resource sharing approaches and sustainable procurement frameworks.

Privacy concerns increasingly shape implementation, with European research highlighting data protection requirements, algorithmic transparency and informed consent as critical considerations. Okur *et al.* (2025, p. 8) show that GDPR compliance functions as a "knockout criterion," making privacy non-negotiable. As a result, institutions must establish robust data governance frameworks that meet regulatory requirements.

Having examined both enablers and impediments, a critical evaluation of the literature corpus reveals its substantial strengths, methodological limitations, and remaining research gaps. This evaluation contextualises the findings presented above and identifies priorities for future investigation.

4   Critical Evaluation of Literature

This section critically evaluates the literature that was used in this review.

4.1   Strengths

The reviewed literature demonstrates notable strengths in geographical diversity, encompassing developed and developing contexts across Asia, Europe and Africa (Turnbull, Chugh and Luck, 2021; Yodihartomo, Aurelia H. and Wijaya, 2022;

Weerapperuma, Nawinna and Gamage, 2024). This breadth enables contextual understanding of e-learning implementation barriers across varying infrastructural and socio-economic conditions. Studies employ diverse methodological approaches, combining quantitative surveys, qualitative interviews and mixed-methods designs, thereby providing multiple analytical perspectives (Singh, Singh and Mishra, 2024). Several investigations demonstrate theoretical sophistication by grounding empirical work in established frameworks, including DeLone and McLean's information systems success model, social capital theory and technology acceptance models (Astuti and Yusdita, 2024; Weerapperuma, Nawinna and Gamage, 2024; Zhang, 2025).

4.2   Limitations

Despite these strengths, significant limitations constrain synthesis efforts (Singh, Singh and Mishra, 2024). Methodological heterogeneity across studies employing varied outcome measures, sample populations and analytical approaches limits direct comparability (Astuti and Yusdita, 2024). Predominant reliance on self-reported data introduces potential social desirability bias whilst limiting objective assessment of learning outcomes (Yodihartomo, Aurelia H. and Wijaya, 2022). Temporal constraints characterise much research, with numerous snapshot investigations rather than longitudinal examinations limiting understanding of sustained impacts (Turnbull, Chugh and Luck, 2021). COVID-19 era research predominance raises generalisability questions beyond emergency contexts (Singh, Singh and Mishra, 2024). The corpus considered in this review is dominated by studies from Asia and Europe, with an absence of work from Latin America and sub-Saharan Africa in the selected sample, which limits the geographical breadth of the review. Insufficient engagement with critical perspectives examining power dynamics, data governance and educational inequalities represents a notable theoretical limitation (Achtypi *et al.*, 2025; Okur *et al.*, 2025).

4.3   Discrepancies

Several contradictions emerge across the literature. A fundamental tension exists between technological determinism, predominantly from engineering and IT research emphasising infrastructure as enabling success, and pedagogical primacy from education scholarship arguing instructional design determines effectiveness (Turnbull,

Chugh and Luck, 2021; Mulaudzi, 2024). This contradiction likely reflects differing success metrics: technical adoption rates versus learning outcomes (Turnbull, Chugh and Luck, 2021; Mulaudzi, 2024). Evidence suggests both perspectives hold partial truth: infrastructure is necessary (Weerapperuma, Nawinna and Gamage, 2024) but insufficient without pedagogical transformation (Mulaudzi, 2024). Chinese research on cognitive evolution engines suggests significant potential for AI-driven personalised learning (Huang *et al.*, 2025), whilst other studies question learning style frameworks' validity (Astuti and Yusdita, 2024). Divergent perspectives on student autonomy versus institutional control manifest, with some studies emphasising learner agency whilst others highlight surveillance and diminished autonomy concerns (Achtypi *et al.*, 2025; Okur *et al.*, 2025).

4.4 Future Directions

Several research priorities emerge. Longitudinal investigations examining sustained impacts on graduate outcomes and career progression remain underexplored (Singh, Singh and Mishra, 2024). Environmental sustainability research investigating carbon footprints, energy consumption and electronic waste requires urgent attention (Okur *et al.*, 2025). Equity-focused research examining diverse student populations, particularly underrepresented minorities and socioeconomically disadvantaged learners, requires expansion (Achtypi *et al.*, 2025). Cross-cultural comparative studies examining implementation across diverse national contexts would enhance contextual understanding (Amrane-Cooper *et al.*, 2023).

5 Conclusion

This review demonstrates that whilst e-learning offers significant potential for accessibility, flexibility and personalisation, effective implementation depends upon complex interplay amongst technological infrastructure, pedagogical expertise, institutional support and contextual factors. A critical implication emerges: institutions must balance infrastructure investment with pedagogical development simultaneously, requiring governance models that position IT departments as pedagogical partners rather than service providers. Success factors encompass system quality, infrastructure, learner characteristics, instructor competence, institutional support,

content design and social capital, with infrastructure and instructor competence as foundational prerequisites (Yodihartomo, Aurelia H. and Wijaya, 2022; Astuti and Yusdita, 2024; Weerapperuma, Nawinna and Gamage, 2024). Barriers operate across technological, pedagogical, social and institutional dimensions (Turnbull, Chugh and Luck, 2021; Yodihartomo, Aurelia H. and Wijaya, 2022; Okur *et al.*, 2025). Successfully leveraging e-learning requires moving beyond technological solutionism towards holistic approaches recognising educational transformation's complex sociotechnical nature (Amrane-Cooper *et al.*, 2023).

Word Count: 2,111

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