



Determinants of E-Learning Effectiveness in Developing Countries: A Systematic Review of Empirical Evidence

¹Maryam Muazu Jodi, ²Junaidu Muazu Jodi, ³Ammar Bathich, ⁴Nurudeen Muhammad Bala
and ⁵Shehu M. SarkinTudu

¹Dept of computer science, Faculty of Science Education, Shehu Shagari University of education

²Dept of Computer Science, Shehu Shagari College of Education

³Dept of Information Technology, Al-Madinah International University, Malaysia

⁴Centre for Satellite Technology, Development, Abuja, Nigeria

⁵Faculty of computing, Sokoto State University

Correspondent Author's Email: Maryammuazuodee@yahoo.com

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ABSTRACT

E-learning adoption in developing countries continues to face significant challenges, including inadequate infrastructure, low digital literacy, and inconsistent institutional support, which limit its overall effectiveness. Existing studies remain fragmented, with limited integration of technological, individual, and institutional determinants, and insufficient methodological rigor, particularly the lack of longitudinal and theory-driven approaches. Moreover, prior review studies exhibit key gaps, including narrow focus on isolated factors, lack of standardized systematic review protocols, limited contextual diversity, and insufficient attention to emerging trends such as artificial intelligence and learner-centered approaches. This study aims to systematically review empirical literature from 2010 to 2026 to identify key determinants influencing e-learning effectiveness and address these gaps. Using a systematic literature review methodology, relevant studies were selected, screened, and analyzed based on predefined inclusion criteria. The findings reveal that multiple determinants significantly influence e-learning outcomes, though often examined in isolation. The study concludes that a holistic, integrated framework and more rigorous, transparent research designs are essential to enhance e-learning effectiveness and sustainability in developing countries.

Keyword's: E-learning, effectiveness; literature review; Digital learning; Technology adoption

1.0 INTRODUCTION

The integration of digital technologies into education has significantly transformed teaching and learning processes worldwide, positioning e-learning as a critical enabler of accessible, flexible, and scalable education. Globally, the e-learning market has experienced substantial growth, with projections exceeding USD 400 billion by 2026, driven by advancements in information and communication technologies (ICTs) and increased demand for remote learning solutions (Ansari, 2025). The COVID-19 pandemic further accelerated this shift, with over 1.6 billion learners affected by school closures, forcing institutions to adopt e-learning platforms rapidly (Virvou, 2023). Despite these advancements, the effectiveness of e-learning systems varies considerably across regions, particularly between developed and developing countries.

In developing countries, multiple challenges hinder the successful implementation and effectiveness of e-learning systems. Empirical evidence indicates that limited internet penetration, inadequate ICT infrastructure, and unreliable electricity supply remain significant barriers. For instance, internet penetration in Sub-Saharan Africa stood at approximately 33% as of 2022, compared to over 90% in developed regions (Mohammed, 2021). Similarly, reports show that nearly 600 million people in Africa lack access to

reliable electricity, which directly affects the usability of digital learning platforms (Elgie, 2021). Beyond infrastructural constraints, institutional challenges such as insufficient policy support, lack of funding, and weak implementation strategies further limit e-learning success (Sun & Zhang, 2024).

Behavioral and human-related factors also play a critical role in shaping e-learning effectiveness. Studies highlight that low digital literacy, resistance to technology adoption, and lack of adequate training among educators and learners significantly influence usage and outcomes (Subramanian & Budhrani, 2020; Virvou, 2023). In many African contexts, teachers often lack the necessary competencies and support systems to effectively integrate e-learning into their instructional practices, thereby reducing system effectiveness and sustainability. These challenges are compounded by socio-cultural factors, including language barriers and attitudes toward technology, which further influence adoption and usage patterns.

A growing body of literature has examined the determinants of e-learning effectiveness using various theoretical frameworks. Models such as the Technology Acceptance Model, Unified Theory of Acceptance and Use of Technology, and DeLone and McLean IS Success Model have been widely employed to explain user acceptance, system usage, and success

outcomes. Prior systematic reviews have contributed to understanding e-learning adoption and effectiveness. For example, *Ansari (2025)* reviewed e-learning systems and identified technological and pedagogical dimensions influencing success, while *Vellore (2015)* synthesized factors affecting e-learning adoption across different contexts. Similarly, *Nasution et al. (2020)* provided a comprehensive framework integrating quality factors and user satisfaction in e-learning environments.

Despite these contributions, several gaps remain in the literature. First, existing reviews often adopt a global perspective without adequately addressing the unique contextual challenges of developing countries, particularly in Africa. Second, many studies focus on either technological or behavioral determinants in isolation, with limited integration of institutional and environmental factors. Third, there is a lack of systematic synthesis of empirical evidence that categorizes determinants of e-learning effectiveness into comprehensive dimensions such as technological, institutional, and behavioral factors. Furthermore, few reviews explicitly focus on post-adoption or effectiveness outcomes, which are critical for evaluating the long-term success and sustainability of e-learning systems. Given these gaps, there is a clear need for a comprehensive and context-sensitive synthesis of the determinants of e-learning effectiveness in developing countries. Therefore, this study conducts a systematic literature review (SLR) to identify, analyze, and categorize key factors influencing e-learning effectiveness, with a particular emphasis on Africa and similar resource-constrained environments. The review aims to integrate findings from empirical studies to develop a holistic understanding of how technological, institutional, and behavioral factors interact to shape e-learning outcomes. The findings of this study are expected to contribute to both theory and practice. Theoretically, the study provides an integrated framework that consolidates fragmented findings across prior studies. Practically, it offers insights for policymakers, educators, and system developers to design and implement more effective and sustainable e-learning solutions in developing contexts.

The remainder of this paper is structured as follows. Section 2 Related studies. Section 3 presents the methodology of the systematic literature review, including search strategy, inclusion and exclusion criteria, and data analysis procedures. Section 4 provides the results of the review, including the identification and classification of key determinants. Section 5 discusses the findings in relation to existing theories and contexts. Section 6 outlines the implications for research and practice, and Section 7 concludes the study with recommendations for future research.

2.0 RELATED STUDIES

Several review studies have emerged on e-learning success and have made significant contributions (Ansari, 2025; Barikzai et al., 2024; Vellore, 2015). For example, Nasution et al. (2020) review E-learning adoption in higher education has expanded, yet high implementation costs do not guarantee successful uptake, as low usage rates often undermine expected benefits. A systematic review of 20 studies identifies success through user satisfaction, actual usage, and continuance intention. Key determinants include learner and instructor characteristics, motivation, system quality, content quality, and organizational support, although the limited sample and database scope restrict generalizability. Vellore (2015) review of the literature indicates that e-learning is expanding across developed and developing contexts due to rising higher education demand and its flexibility. However, the discussion is largely descriptive, overlooking theoretical grounding and empirical validation. While user readiness, motivation, government support, and tutor competence are highlighted as key drivers, limited attention is given to contextual disparities and measurement of effectiveness, reducing the depth and generalizability of the conclusions.

Barikzai et al. (2024) conducted a review of the literature and reveals that this scoping review offers a comprehensive synthesis of e-learning implementation in emerging economies, identifying success, failure factors, and contextual challenges. Despite its broad coverage and systematic rigor, the study remains largely descriptive, with limited theoretical integration and empirical validation. While it highlights infrastructural and contextual complexities, insufficient emphasis on comparative analysis and measurable outcomes constrains its applicability and generalizability across diverse settings. *Ansari (2025)* review of the literature shows that this SLR provides a robust synthesis of e-learning and blended learning effectiveness using PRISMA, bibliometric mapping, and thematic analysis. It identifies technological, pedagogical, individual, social, and institutional determinants, with engagement and satisfaction mediating outcomes. However, despite methodological rigor, limited critical comparison across contexts and insufficient empirical validation of proposed relationships constrain its explanatory depth and generalizability.

A critical gap in the literature lies in the lack of context-specific, empirically validated, and theory-driven syntheses of e-learning effectiveness in developing countries. Prior reviews (*Ansari, 2025; Barikzai et al., 2024; Nasution et al., 2020; Vellore, 2015*) are largely descriptive, limited in scope, and lack comparative and integrative analysis across contexts. They

insufficiently examine measurable outcomes and interactions among determinants. Therefore, a systematic review focusing on empirical evidence in developing countries is needed to provide robust, generalizable, and context-sensitive insights. Although the e-learning effectiveness is also a topic in Computer Science, and Education, this study only looks into the contributions of these fields and compare it to those of the IS field. The goal of this study is to provide an overview of previous research that focused on the e-learning effectiveness. The followings are the research questions:

RQ1: How many published IS and related fields are involved in the e-learning effectiveness?

RQ2: How many theories and research techniques have been applied to the study of e-learning effectiveness?

RQ3: What are the possible avenues for research on the e-learning effectiveness?

3.0 METHODOLOGY

This study followed the guidelines for conducting a systematic literature review provided by (2007 Kitchenham & Charters, 2007). Firstly, the review process started by developing a simple protocol that outlines the research questions, the search strategy, the selection criteria, the quality assessment criteria and the data extraction strategy. The following sections summarize the conducted review process.

3.1 Search Process

In order to find the relevant articles to be included in the review, a systematic search for e-learning effectiveness literature from the point of view of the IS domain was conducted (Sarkintudu et al., 2019). The leading databases in IS such as AIS Electronic Library, Scopus were investigated. The specific search terms used were ("e-learning" OR "online learning" OR "digital learning") AND ("effectiveness" OR "success" OR "user satisfaction" OR "net benefits") AND ("determinants" OR "factors" OR "predictors") AND ("developing countries" OR "Africa") AND ("TAM" OR "UTAUT" OR "IS success model" OR "DeLone and McLean") which resulted to 257 primary papers.

3.2 Selection Process

At this stage, the articles were selected based on these three criteria: 1) AIS senior scholars journals from 2017 to 2026 such as AJIS, CAIS, 2) higher ranked IS chapters conference proceedings such as AMCIS, ICIS, PACIS, and 3) other related and non-IS databases such as EBSCOhost. From the selection, only fifteen (15) papers fulfilled the first criteria whilst 140 and 102 met the second and third respectively as shown in Figure 1. The systematic selection process illustrated in the figure demonstrates a rigorous and transparent multi-stage filtering approach consistent with PRISMA guidelines. Initially, a total of 257 papers were

identified after duplicate removal during the identification stage. This indicates a broad and comprehensive search across multiple databases, ensuring adequate coverage of the relevant literature. During the screening phase, 59 papers were excluded based on title review due to lack of alignment with the study focus, reducing the pool to 198 papers. This step highlights the importance of preliminary relevance checking to eliminate clearly unrelated studies. Subsequently, abstract screening led to the exclusion of an additional 113 papers, leaving 85 studies for further consideration. This substantial reduction reflects the strict application of inclusion criteria to ensure conceptual relevance and empirical rigor.

In the eligibility stage, full-text assessments were conducted on the remaining 85 papers. At this point, 49 papers were excluded due to issues such as inadequate methodological quality, lack of empirical evidence, or misalignment with the study objectives. This stage is critical as it ensures that only high-quality and contextually relevant studies are retained. Finally, 36 papers met all inclusion criteria and were selected for the final analysis. This final sample represents the most relevant and methodologically sound studies for synthesizing evidence on the determinants of e-learning effectiveness in developing countries. Overall, the process reflects a systematic, unbiased, and reproducible approach, ensuring the reliability and validity of the review findings.

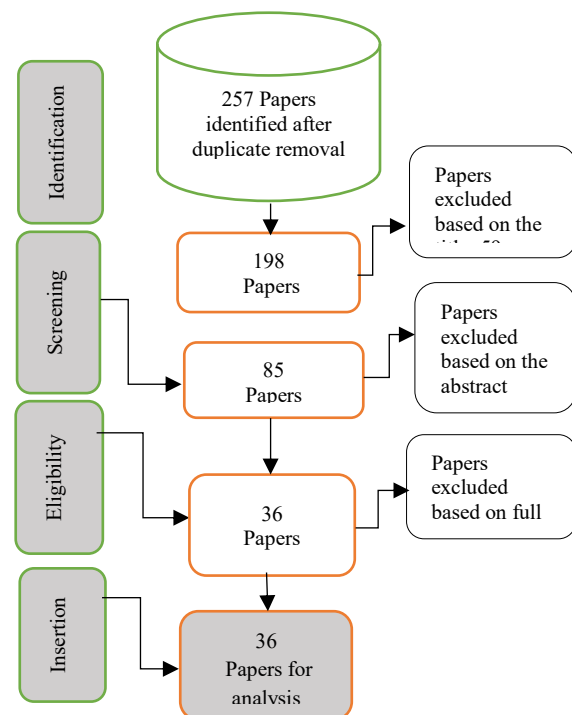


Figure 1: Search And Selection Procedure

3.3 Quality Assessment Phase 1

The methodological quality of the selected studies was systematically evaluated using predefined criteria.

Each paper was assessed based on four key aspects: (1) clarity of research objectives, (2) appropriateness of data collection methods, (3) suitability of data analysis techniques, and (4) clarity of reported findings. For each criterion, a score of 1 was assigned if fully satisfied, 0.5 if partially satisfied, and 0 if not satisfied. These criteria were adapted from established quality assessment guidelines in prior literature. The overall quality score for each paper was computed by summing the individual criterion scores. The assessment results indicate that out of the 36 papers reviewed, 34 demonstrated high methodological quality and were rated as “very good,” while only 2 papers were classified as poor due to limitations in clarity and methodological rigor.

Table 1: Quality Score

Quality Category	Number of papers (N = 36)	Percentage (%)
Very Good	34	94.4%

Poor	2	5.6%
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Poor	2	5.6%
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3.4 Quality Assessment Phase 2

A series of seven (7) checklist questions from (*Alshamsi et al., 2022*) were used for the second quality assessment, which shaped a procedure to evaluate the final chosen research papers (n=36) for final analysis. This checklist question, which was modified from (*Kitchenham & Ebse, 2007*), was designed to assess the quality of paper rather than to evaluate the work of academics. In contrast to the inclusion/exclusion criteria mentioned above, each checklist question was rated on a three-point scale: a score of 1 was assigned for clear objectives, a score of 0.5 for partially clear objectives, and a score of 0 for unclear objectives. This resulted in scores ranging from 1 to 9 for each study. As shown in Table 2, this method, which was motivated by suggestions made by *Kitchenham & Ebse (2007)*, sought to assess the quality of research rather than criticize the paper of academics.

Table 2: Evaluation Checklist Criteria

S/n	Checklist dimensions	Number
1	Are the research objectives clearly stated?	Q1
2	Was the aim of the study on E-Learning effectiveness?	Q2
3	Are the variables addressed the study E-Learning effectiveness clearly outlined?	Q3
4	Is the studies' context of E-Learning effectiveness clearly articulated?	Q4
5	Are the methods of data collection adequately and the instrument reliable and valid?	Q5
6	Are the data analysis technique adequate?	Q6
7	Do the findings of the studies contribute to existing literature on E-Learning effectiveness?	Q7

Source: (Alqudah & Al-emran, 2021)

Based on seven quality evaluation checklist criteria, higher scores indicated a stronger connection with the research objectives. Each study was given an independent assessment by the authors, who then discussed and reviewed any contested paper to settle any disagreements. The quality evaluation results for the 36 papers are shown in Table 3, demonstrating that every paper satisfied the requirements and was deemed suitable for final analysis.

Table 3: Quality Evaluation Result

S/n	Papers	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Total	Percentage%
1	(C.H. et al., 2023)	1	1	1	0.5	1	0	1	5.5	78.5
2	(P. & Isaias, 2012)	1	1	1	1	1	0.5	1	6.5	92.8
3	(Havinen, 2024)	1	1	1	1	1	0	1	6.0	85.7
4	(J. & Kaivo-oja, 2024)	1	1	1	1	1	0.5	1	6.5	92.8
5	(A.M. et al., 2021)	1	0.5	0.5	1	0.5	0.5	1	5.0	71.4
6	(D. et al., 2023)	1	0	1	0.5	1	1	0.5	5.0	71.4
7	(Romí, 2023)	1	0.5	0.5		1	0	1	5.0	71.4
8	(Venkata, 2020)	1	0.5	0.5	1	0.5	0.5	0.5	4.5	64.2
9	(B.G.P. et al., 2019)	1	1	1	1	1	1	0.5	6.5	92.8
10	(N.J. & Ashill, 2018)	1	1	0.5	1	0.5	0.5	1	5.5	78.5
11	(E. H. F. . et al., 2023)	1	1	1	0.5		1	1	6.5	92.8
12	(Sugiono et al., 2020)	1	1	0.5	1	0.5	0.5	1	5.5	78.5
13	(M.-C. & Liu, 2023)	1	1	1	1	1	0.5	1	6.5	92.8
14	(Mohammadi, 2015)	1	1	1	1	1	0	1	6.0	85.7
15	(D.Y. et al., 2010)	1	0.5	0.5	1	0.5	0.5	0.5	4.5	64.2
16	(S. et al., 2022)	1	1	0.5	1	0.5	0.5	0.5	5.0	71.4
17	(M. & Aparicio, 2023)	1	1	0.5	1	0.5	0.5	1	5.5	78.5
18	(Y. et al., 2017)	1	1	1	1	1	1	0	6.0	85.7
19	(Z. et al., 2010)	1	0.5	1	0.5	0.5	0.5	1	5.0	71.4
20	(P. N. et al., 2012)	1	0.5	1	1	1	0.5	1	6.0	85.7
21	(Alghamdi, 2025)	0.5	1	0.5	0	0.5	0.5	1	4.0	57.1
22	(Özkan, 2010)	1	1	1	1	1	0.5	1	6.5	92.8

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23	(Alnaqbi; A.M., 2021)	1	0.5	1	1	1	1	1	6.5	92.8
24	(Naidoo, 2023)	1	1	1	1	0.5	0.5	1	6.0	85.7
25	(Wang Y., 2024)	1	1	1	0.5	1	0.5	1	6.0	85.7
26	(Aliway & Safie, 2018)	0.5	1	1	1	1	1	1	6.0	85.7
27	(Chukwuere J., 2016)	1	1	1	1	1	0.5	1	6.5	92.8
28	(Ulinuha Z. E.N., 2022)	1	0.5	0.5	1	1	0	1	5.0	71.4
29	(Lin .-J., 2012)	1	1	0.5	1	0.5	0.5	1	5.5	78.5
30	(Al-Khasawneh A., 2015)	1	1	0.5	1	0.5	0.5	1	5.5	78.5
31	(Fainholc B., 2014)	1	1	1	1	1	0.5	1	6.5	92.8
32	(Arifin, 2022)	1	1	1	1	1	0.5	1	6.5	92.8
33	(Elmouhib, 2025)	1	0.5	1	1	1	0.5	1	6.0	85.7
34	(Rosetta A.M., 2020)	1	0.5	0.5	1	0.5	0.5	1	5.0	71.4
35	(Nguyen, 2026)	1	1	1	0.5	1	1	1	6.5	92.8
36	(Lee & Shu., 2019)	1	1	0.5	1	0.5	0.5	1	5.5	78.5

3.4 Extraction of Data

Each paper's reference information was recorded using the reference management program Mendeley software platform (<http://www.mendeley.com/>). The disciplines of study, the techniques, and the theory employed are all included in the data that was retrieved to address each of the research questions.

4.0 RESULTS

RQ1: How many published IS and related fields are involved in the e-learning effectiveness?

4.1 Field

The analysis of the 36 selected studies demonstrates that e-learning effectiveness is inherently interdisciplinary, drawing on multiple academic domains. Evidence from the reviewed literature supports the classification of six major fields contributing to this research area. First, Information Systems (IS) emerges as the dominant field. A substantial proportion of the studies employ established IS theories such as the DeLone and McLean IS Success Model, the Technology Acceptance Model (TAM), and various hybrid frameworks to evaluate system quality, information quality, service quality, user satisfaction, and continuance intention. For example, (D.Y. et al., 2010) validated the IS success model in an e-learning context, while (Mohammadi, 2015) and (Özkan, 2010) extended IS-based measurement models to assess effectiveness. Similarly, integration of TAM and IS success constructs is evident in studies such as (Ulinuha Z. E.N., 2022) and (Aliway & Safie, 2018), confirming the centrality of IS perspectives in explaining e-learning success. The second major domain is Education and Pedagogy, where emphasis is

placed on learning outcomes, instructional design, and learner engagement. Studies such as (Arifin, 2022), (Naidoo, 2023), and (Fainholc B., 2014) explore how pedagogical design and teaching strategies influence the effectiveness of e-learning systems, particularly in higher education contexts.

Third, Computer Science and Artificial Intelligence contribute significantly through the development of adaptive systems, predictive analytics, and data-driven evaluation models. For instance, (M.-C. & Liu, 2023) and (Sugiono et al., 2020) apply machine learning and neural network techniques to predict e-learning success, while (Wang Y., 2024) highlights the role of AI in enhancing system performance and learner outcomes. In addition, Management and Organizational Studies play an important role by examining organizational learning, coordination, and institutional performance. Research such as (Y. et al., 2017), (Nguyen, 2026), and (Rosetta A.M., 2020) emphasizes the influence of organizational readiness, strategy, and collaboration on successful e-learning implementation. Another contributing domain is Health and Medical Education, where e-learning effectiveness is assessed within clinical and telehealth environments. Studies like (Z. et al., 2010) and (Alnaqbi; A.M., 2021) demonstrate how e-learning supports professional training and healthcare delivery, highlighting domain-specific success factors. Finally, Social Sciences and Psychology provide insights into behavioral and cognitive factors affecting e-learning effectiveness. Issues such as motivation, self-efficacy, and bias are examined in studies like (Havinen, 2024) and (Chukwuere J., 2016), which show how user perceptions and attitudes influence system use and outcomes. As shown in table 4.

Table 4: Perspectives

S/N	Field / Discipline	Focus Area in E-learning Effectiveness	No. of Papers
1	Information Systems (IS)	IS success models, system quality, user satisfaction	15
2	Education & Pedagogy	Learning outcomes, instructional design, engagement	8
3	Computer Science	Adaptive learning, ML prediction, system development	5
4	Management & Organizational	Organizational performance, teamwork, strategy	4
5	Health / Medical Education	E-learning in healthcare training and telehealth	2
6	Social Sciences / Psychology	Behavioral factors, motivation, cognitive aspects	2
Total			36

4.2 Theories Used

RQ2: How many theories and research techniques have been applied to the study of e-learning effectiveness?

The review of the 36 selected studies further confirms that e-learning effectiveness research is underpinned by multiple theoretical foundations and diverse methodological approaches, reflecting the complexity and maturity of the domain. From a theoretical standpoint, the evidence indicates that a wide range of theories have been applied, with a strong dominance of Information Systems (IS) theories. In particular, the

DeLone and McLean IS Success Model remains the most extensively utilized framework for assessing e-learning effectiveness, especially in terms of system quality, information quality, service quality, user satisfaction, and net benefits (*D.Y. et al., 2010; Mohammadi, 2015; Özkan, 2010*). Similarly, the Technology Acceptance Model (TAM) is frequently adopted to explain user acceptance and behavioral intention toward e-learning systems (*Lin.-J., 2012; Al-Khasawneh A., 2015*). As shown in Table 5.

Table 5: Theories and models used

S/N	Theory / Model	Application in Studies	Frequency
1	DeLone & McLean IS Success Model	System success measurement	10
2	Technology Acceptance Model (TAM)	User acceptance and intention	7
3	Integrated TAM + IS Models	Combined behavioral and system evaluation	6
4	Task-Technology Fit (TTF)	Alignment of tasks and system features	3
5	AI / Machine Learning Models	Prediction and personalization	3
6	Connectivism	Learning theory for digital environments	2
7	Organizational Learning Theory	Institutional learning processes	2
8	Other Hybrid Frameworks	Context-specific models	3
Total			36

Consistent with trends in IS research, several studies move beyond single-theory applications by integrating TAM and IS Success models to provide a more comprehensive understanding of both adoption and post-adoption behaviors (*Ulinuha Z. E.N., 2022; Aliway & Safie, 2018*). This integration demonstrates an effort to address the limitations of standalone models and improve explanatory power. In addition to these dominant frameworks, other IS and learning-related theories such as Task-Technology Fit (TTF) (*Lee & Shu, 2019*), Connectivism (*Chukwuere J., 2016*), and Organizational Learning Theory (*Y. et al., 2017*) are also applied to capture technological alignment, digital learning processes, and institutional readiness, respectively. However, despite the presence of multiple theories, the review reveals that theoretical application remains somewhat concentrated, with relatively limited exploration of alternative or emerging perspectives. Only a few studies incorporate emerging technology-driven frameworks, such as Artificial Intelligence, Big Data, and advanced analytics, to enhance predictive capabilities and system intelligence (*M.-C. & Liu, 2023; Wang Y., 2024*). This suggests that while the field is evolving, the adoption of advanced theoretical paradigms is still at a developing stage. From a methodological perspective, the findings show that quantitative approaches dominate the literature. Most studies rely on survey-based data collection analyzed using Structural Equation Modeling (SEM), Partial Least Squares SEM (PLS-SEM), and regression techniques to test hypotheses and validate theoretical relationships (*D.Y. et al., 2010; Mohammadi, 2015; Lee & Shu, 2019*). This methodological preference reflects the strong

influence of positivist research traditions within IS and e-learning studies.

Nevertheless, similar to the diversification observed in theoretical approaches, there is evidence of growing methodological variety. Some studies employ systematic literature reviews (SLR) to synthesize existing knowledge and identify research gaps (*Z. et al., 2010*), while others adopt case study approaches to provide in-depth contextual insights into e-learning implementation (*Naidoo, 2023; Rosetta A.M., 2020*). Furthermore, the application of machine learning and predictive analytics techniques is gaining traction, enabling researchers to model learner behavior and predict e-learning outcomes more accurately (*Sugiono et al., 2020; M.-C. & Liu, 2023*). Inclusive, the coexistence of multiple theoretical perspectives and methodological approaches indicates that e-learning effectiveness research is both theoretically rich and methodologically pluralistic. However, similar to observations in other emerging domains, the field still exhibits a concentration around a limited set of dominant IS theories, suggesting that further exploration of alternative and integrative frameworks is needed. This presents an important opportunity for future research to develop more holistic and context-sensitive models that combine technological, behavioral, and organizational dimensions in evaluating e-learning effectiveness.

4.3 Methods Used

The methodological analysis of the reviewed studies indicates a strong dominance of quantitative, survey-based approaches, which are widely used to examine

relationships among variables influencing e-learning effectiveness. These approaches typically rely on structured questionnaires and large sample sizes to ensure generalizability of findings (Mohammadi, 2015; Al-Khasawneh A., 2015). In particular, Structural Equation Modeling (SEM) and its variants are frequently employed as the primary analytical tools for hypothesis testing and model validation, enabling researchers to assess complex relationships between constructs such as system quality, user satisfaction, and continuance intention (D.Y. et al., 2010; Lee & Shu, 2019). This dominance reflects the positivist orientation of e-learning research, where emphasis is

placed on theory testing and empirical validation. Alongside these traditional quantitative methods, there is a growing adoption of advanced analytical techniques, including machine learning models, which are used for predictive analytics and performance forecasting in e-learning environments (*M.-C. & Liu, 2023; Sugiono et al., 2020*). Similarly, fuzzy-based methods such as FANP and AHP are increasingly utilized to support decision-making processes and prioritize critical success factors under conditions of uncertainty (*C.H. et al., 2023; Ulinuha Z. E.N., 2022*). As shown in Table 6.

Table 6: Research Methods

Method	Description	Supporting Studies
Quantitative (Survey-based)	Dominant approach	(Mohammadi, 2015); (Al-Khasawneh A., 2015)
Structural Equation Modeling (SEM)	Hypothesis testing	(D.Y. et al., 2010); (Lee & Shu., 2019)
Machine Learning Models	Predictive analytics	(M.-C. & Liu, 2023); (Sugiono et al., 2020)
Fuzzy Methods (FANP, AHP)	Decision-making models	(C.H. et al., 2023); (Ulinuha Z. E.N., 2022)
Case Study	Contextual insights	(Naidoo, 2023); (Rosetta A.M., 2020)
Comparative Studies	Cross-group analysis	(D. et al., 2023)
Mixed Methods	Combined approaches	(Nguyen, 2026)

Despite the dominance of quantitative techniques, the review also highlights an emerging trend toward methodological diversification. Qualitative approaches such as case studies provide rich, context-specific insights into the implementation and effectiveness of e-learning systems, particularly within institutional and organizational settings (Naidoo, 2023; Rosetta A.M., 2020). In addition, comparative studies are employed to examine differences across groups or contexts, thereby enhancing the generalizability and robustness of findings (D. et al., 2023). The inclusion of mixed methods research further strengthens the field by combining the rigor of quantitative analysis with the depth of qualitative insights, allowing for a more comprehensive understanding of e-learning effectiveness (Nguyen, 2026). Overall, the coexistence of these diverse methodological approaches demonstrates that while the field remains largely quantitative, it is progressively evolving toward more integrative and flexible research designs capable of capturing the multifaceted nature of e-learning systems.

5.0 POTENTIAL RESEARCH OPPORTUNITIES ON THE E-LEARNING EFFECTIVENESS

RQ3: What are the possible avenues for research on the e-learning effectiveness?

The studies reviewed so far provide important insights that can guide both Information Systems (IS)

researchers and practitioners in understanding e-learning effectiveness. However, the evidence indicates that much of the existing literature remains narrow in scope and perspective, particularly due to the over-reliance on student-centered evaluations. A significant number of studies focus primarily on learners' perceptions, satisfaction, and performance, with limited attention given to teachers, who are critical stakeholders in the e-learning ecosystem (Arifin, 2022; Naidoo, 2023). In addition, there is a limited focus on developing countries, especially in African contexts, where infrastructural, cultural, and socio-economic challenges differ significantly from developed regions (Elmouhib, 2025; Chukwuere J., 2016). Furthermore, many studies lack comprehensive and unified theoretical frameworks, often applying isolated models without adequately integrating technological, behavioral, and contextual factors (Ulinuha Z. E.N., 2022). Although some scholars have employed established IS theories, more effort is needed to systematically apply and extend these theories to better capture the complexity of e-learning effectiveness.

This study, therefore, provides evidence that highlights several critical research opportunities for future investigation. The findings suggest that existing research has largely emphasized adoption and initial usage, with insufficient attention given to post-adoption behavior, continuance intention, and long-term sustainability of e-learning systems (*Mohammadi,*

2015; Lee & Shu., 2019). Moreover, there is a noticeable neglect of institutional and policy-related factors, such as governance structures, organizational readiness, and infrastructural support, which are essential for successful implementation and scalability (Y. et al., 2017). The review also reveals that limited efforts have been made to develop integrated models that combine IS theories with contextual realities, particularly in developing regions. Consequently, there is a need for future studies to explore holistic, context-sensitive frameworks that incorporate teacher perspectives, institutional dynamics, and post-adoption outcomes. Addressing these gaps will not only advance theoretical development but also provide practical implications for improving e-learning effectiveness in diverse educational settings.

6.0 CONCLUSION

Despite the growing body of research on e-learning effectiveness in developing countries, this systematic review highlights that significant gaps still exist in understanding how various determinants interact to influence learning outcomes. The study confirms that technological factors (such as system quality and infrastructure), individual factors (including digital literacy and motivation), and institutional factors (such as policy support and teacher competency) collectively shape e-learning effectiveness. However, the integration of these determinants into a unified theoretical framework remains limited, and many studies rely on fragmented models with insufficient theoretical grounding. Furthermore, the findings reveal that although empirical studies have increased in recent years, the application of rigorous and standardized methodological approaches is still inconsistent. Many studies depend on cross-sectional data and lack longitudinal or experimental designs that could provide deeper insights into causality. In addition, there is limited contextual diversity, as most studies focus on specific regions or institutions, thereby restricting generalizability.

This review also acknowledges its limitations. The inclusion criteria were restricted to selected academic databases, potentially excluding relevant studies from interdisciplinary sources such as sociology, policy studies, and development research. Moreover, variations in measurement scales and constructs across studies may affect the comparability of findings. Compared to earlier systematic reviews, this study advances the literature by synthesizing empirical evidence across multiple determinants and highlighting the interconnected nature of e-learning effectiveness in developing contexts. Nevertheless, the dynamic and evolving nature of digital learning environments suggests that continuous research is necessary to capture emerging trends, technologies, and pedagogical innovations.

7.0 RECOMMENDATION FOR FUTURE WORK

Future systematic literature review (SLR) studies on e-learning effectiveness in developing countries should adopt more rigorous and transparent review protocols, such as SPAR-4-SLR, to enhance methodological consistency, replicability, and credibility. Clear inclusion and exclusion criteria, comprehensive database coverage, and detailed reporting of the review process are essential to minimize bias and improve the quality of evidence synthesis. Subsequent reviews should expand their scope by incorporating interdisciplinary databases, including education, sociology, economics, and public policy sources, to capture a broader perspective on e-learning effectiveness. This will help address the current limitation of discipline-specific reviews and provide a more holistic understanding of the phenomenon. Future SLRs are also encouraged to employ advanced bibliometric and scientometric techniques, such as co-citation analysis, keyword co-occurrence, and thematic mapping, to identify emerging research trends, influential studies, and intellectual structures within the field. Combining bibliometric analysis with qualitative synthesis can provide deeper insights into both the evolution and gaps in the literature. Additionally, there is a need for more comparative and longitudinal review studies that examine how e-learning effectiveness evolves over time and across different developing regions. Such reviews can highlight contextual differences, policy impacts, and technological advancements influencing outcomes.

Another important direction is the standardization of constructs and operational definitions used in the literature. Future SLRs should critically evaluate and harmonize key variables (e.g., system quality, learner engagement, digital readiness) to improve consistency and comparability across studies. Finally, future reviews should place greater emphasis on underexplored areas, including rural and low-resource settings, inclusive education, gender disparities, and the impact of emerging technologies such as artificial intelligence and learning analytics. Addressing these gaps will strengthen the relevance and practical implications of SLR studies and contribute to more effective and inclusive e-learning strategies in developing countries.

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