frontiers | Frontiers in Education

TYPE Systematic Review
PUBLISHED 25 August 2025
DOI 10.3389/feduc.2025.1526076

OPEN ACCESS

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RECEIVED 11 November 2024
ACCEPTED 25 July 2025
PUBLISHED 25 August 2025

CITATION
Olawale BE, Omodan BI and Saddiq K (2025) X-raying the enablers and barriers of e-learning in higher education institutions: a systematic review.
Front. Educ. 10:1526076.
doi: 10.3389/feduc.2025.1526076

X-raying the enablers and barriers of e-learning in higher education institutions: a systematic review

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Introduction: In recent years, the landscape of higher education has undergone significant transformation, largely driven by technological advancements and the increasing demand for flexible learning options. E-learning, defined as the use of electronic technologies to access educational curricula outside of a traditional classroom, has emerged as a critical component of this evolution. This systematic review aims to identify and analyse the enablers and barriers associated with e-learning in the higher education sector, thereby contributing to the ongoing discourse surrounding its effectiveness and implementation.

Method: A comprehensive literature search was conducted across multiple academic databases, including JSTOR, Scopus, ERIC, and Science Direct, to gather relevant studies published between 2015 and 2025. The inclusion criteria focused on empirical research that examined e-learning in higher education. Data were extracted and analysed using thematic analysis to categorise the enablers and barriers identified in the literature.

Result: The review identified several key enablers of e-learning, including technological advancement, diverse learning resources, flexibility and accessibility, and cost-effectiveness. Conversely, barriers such as lack of motivation and self-discipline, technical issues, faculty resistance to change, and inadequate technological infrastructure were also prominent. The findings suggest that addressing these barriers while leveraging enablers is crucial for the successful adoption of e-learning in higher education institutions.

Conclusion: This systematic review contributes significantly to the existing body of knowledge surrounding e-learning in higher education. By elucidating the enablers and barriers that influence e-learning implementation, the study provides valuable insights for policymakers, educators, and administrators. As the landscape of higher education continues to evolve, the insights gained from this review can serve as a foundational resource for improving e-learning outcomes and ensuring that institutions are well-equipped to navigate the challenges and opportunities presented by this transformative approach to education. Ultimately, fostering an environment that embraces both the potential of e-learning and the necessary support structures will be crucial for the future success of higher education institutions in an increasingly digital world.

KEYWORDS

barriers, enabler, E-learning, higher education institution, technology

1 Introduction

In recent years, the landscape of higher education has undergone a significant transformation, driven largely by technological advancements and the increasing demand for flexible learning options. E-learning, characterised by the use of electronic technologies to access educational curricula outside of a traditional classroom, has emerged as a pivotal component of this evolution. As institutions strive to meet the diverse needs of students and adapt to the rapidly changing educational environment, understanding the factors that facilitate or impede the successful implementation of e-learning initiatives becomes paramount. Thus, studies indicate that the term e-learning encompasses various meanings or interpretations (Sangrà et al., 2012; Kumar Basak et al., 2018); however, its primary component is the utilisation of technology to provide online access to educational resources that enhance learning. E-learning is characterised as an educational approach that enhances learning through the utilisation of information technology and communication, hence granting learners access to necessary educational programmes (Khan, 2015; Kumar Basak et al., 2018; Alnemrat et al., 2023). The term e-learning is synonymous with web-based learning, online education, computer-assisted instruction, computer-based instruction, internet-based learning, multimedia learning, technology-enhanced learning, and virtual learning (Karnatak et al., 2015; Trelease, 2016; Wang and WANG, 2018). This terminology has caused ambiguity regarding whether e-learning pertains to the medium (e.g., computer-assisted instruction) or the delivery method (e.g., online learning). E-learning, often defined as the use of electronic technologies to access educational curricula outside of a traditional classroom setting, encompasses a wide range of modalities, including online courses, virtual classrooms, and blended learning environments (Abd-Elsayed et al., 2015; Anderson, 2017; Aladwan et al., 2018; Al Rawashdeh et al., 2021). Theoretical frameworks such as Community of Inquiry (CoI) and Connectivism have been instrumental in understanding the dynamics of e-learning. The CoI framework posits that meaningful learning occurs through the interplay of cognitive, social, and teaching presence, emphasising the importance of interaction and collaboration in online learning environments (Garrison and Akyol, 2015; Suppiah et al., 2019).

Conversely, Connectivism, proposed by Mukhlisa (2024) and Siemens (2005), argues that learning in the digital age occurs through networks and connections, highlighting the significance of technology in facilitating knowledge acquisition and dissemination. The shift to e-learning necessitates a re-evaluation of pedagogical approaches. Research indicates that e-learning fosters active learning through interactive content, collaborative projects, and immediate feedback mechanisms (Khan et al., 2017; Spring and Graham, 2017; Chen and Swan, 2020). For instance, studies have shown that incorporating multimedia elements, such as videos and simulations, enhances student engagement and comprehension (Shelton et al., 2016; Mayer, 2017; Hung and Chen, 2018; Alnemrat et al., 2023). Furthermore, e-learning can provide personalised learning experiences, allowing students to progress at their own pace and tailor their educational journeys according to individual needs (Alamri et al., 2021; Gligorea et al., 2023; Verma et al., 2024). Research has also demonstrated that well-structured e-learning environments can improve learning outcomes, increase student satisfaction, and lead to higher retention rates (Violante and Vezzetti, 2015; Yurdugül and Çetin, 2015; Daultani et al., 2021; Innab et al., 2022). Technological advancements have played a crucial role in the proliferation of e-learning in higher education. The emergence of Learning Management Systems (LMS) such as Moodle, Blackboard, and Canvas has facilitated the organisation and delivery of online courses (Mncube et al., 2021; Shurygin et al., 2021; Almarashdeh, 2016). These platforms provide educators with tools to create, manage, and assess learning activities while also enabling students to access resources and collaborate with peers. Additionally, the integration of emerging technologies, such as artificial intelligence (AI), virtual reality (VR), and augmented reality (AR), is reshaping the e-learning landscape (Trelease, 2016; Olawale, 2024). AI-driven personalised learning systems can analyse student performance and adapt content accordingly, while VR and AR offer immersive learning experiences that can enhance the understanding of complex concepts (Hwang et al., 2020; Olawale, 2024). Moreover, mobile learning, or m-learning, has gained traction as a complementary mode of e-learning, allowing students to access educational resources anytime and anywhere (Pereira and Rodrigues, 2013; Nyembe and Howard, 2019). The proliferation of smartphones and tablets has made it increasingly feasible for learners to engage with course materials on the go, thus promoting flexibility and accessibility in higher education (Wong and Looi, 2011).

Despite the numerous advantages of e-learning, several challenges persist in its implementation within higher education institutions. One of the primary concerns is the digital divide, which refers to the disparities in access to technology and the internet among different socio-economic groups (Cullen, 2001; Ghobadi and Ghobadi, 2015; Sims et al., 2008). Students from low-income backgrounds may face barriers to participating in e-learning due to inadequate access to devices or reliable internet connectivity. This inequity can exacerbate existing educational inequalities and hinder the potential benefits of e-learning for all students (Van Dijk, 2006; Deng and Sun, 2022). Additionally, the shift to e-learning requires significant changes in institutional culture and faculty training. Many educators lack the necessary skills and confidence to effectively design and deliver online courses (Bates and Sangra, 2011; Tugwell and Maduabuchukwu, 2020). Professional development programmes that focus on pedagogical strategies for e-learning and the use of technology are essential to equip educators with the competencies needed to thrive in a digital learning environment (Anderson, 2005; Ottenbreit-Leftwich et al., 2010). Another challenge is the potential for decreased student engagement and motivation in online learning environments. Research has indicated that the absence of face-to-face interaction can lead to feelings of isolation and disconnection among students (Palloff and Pratt, 2009; Mutongoza and Olawale, 2022). Nonetheless, while the swift advancement of technology has fundamentally altered several areas, including higher education, e-learning has become a prominent method of education delivery, propelled by the widespread availability of digital tools and materials (Almarashdeh, 2016; Mutongoza and Olawale, 2022). Despite the increasing acceptance of e-learning in higher education institutions (HEIs), the success and sustainability of these programs depend on a complex interaction of many facilitators and obstacles. Understanding these factors is essential for stakeholders, including educators, administrators, policymakers, and students, as they address the problems and possibilities inherent in e-learning settings. Regardless of the growing corpus of literature on the subject, a thorough review of more current research on the facilitators and obstacles to e-learning in higher education is conspicuously absent. This gap is significant as it impedes a thorough comprehension of the

complex dynamics that affect the execution and efficacy of e-learning initiatives. Thus, the uniqueness of this review resides in its ability to integrate varied viewpoints and experiences from different empirical studies to provide significant resources for practitioners and decision-makers aiming to improve e-learning frameworks. By identifying key enablers and barriers to e-learning in HEIs, this review informs interventions and policy formulations that enhance its integration in higher education institutions, therefore fostering a more inclusive and flexible educational environment.

2 Methods

This study employed a systematic literature review (SLR) methodology. Systematic literature reviews are regarded as a significant research methodology that adheres closely to scientific principles, as they are "designed to locate, appraise, and synthesize the best available evidence" pertinent to the research objective, thereby facilitating "informative and evidence-based" findings (Dickson, 2017; Boland et al., 2023). A systematic search for articles published on e-learning in higher education institutions was conducted in JSTOR, Scopus, ERIC, and ScienceDirect from 2015 to 2025. The primary search terms were "e-learning" and "higher education," using 'Textword searching' (i.e., searching for a word or phrase appearing anywhere in the citation—article title, journal name, author, etc.) rather than the full text of an article, and 'Thesaurus (LCSH, AACE) searching', employing Boolean operators and truncations. The search strategy included the following terms: ("e-learning" OR "online learn*" OR "distance learning" OR "computer-assisted instruction" OR "web-based learning" OR "internet-based learning" OR "multi-media learning" OR "technology-enhanced learning" OR "distributed learning" OR "virtual classroom" OR "virtual environment" OR "virtual learning") AND ("higher education institution" OR "higher education" OR "tertiary education" OR "postsecondary education" OR "advanced education" OR "graduate education" OR "public further education" OR "university education") AND ("challenges" OR "barriers" OR "enablers" OR "facilitator") (see Table 1).

Based on the inclusion and exclusion criteria, the literature obtained from the databases underwent a two-stage screening process. In the first stage, abstracts and titles were reviewed to determine compliance with the minimum inclusion requirements. In the second stage, the complete texts of the included papers were examined using a critical assessment instrument (Kmet et al., 2004). Thus, Means et al. (2010) contend that "the objective of the two-stage approach was to enhance efficiency while avoiding the exclusion of potentially pertinent, high-quality studies on the effects of online learning." The typical PRISMA flowchart has been used to illustrate the study selection procedure (Moher et al., 2010).

According to the final search results, 21 papers were identified for inclusion in the review, predominantly of a quantitative nature. Thus, Clarke (2007) contends that when methodological heterogeneity exists, "systematic review does not require the amalgamation of study results to yield an average estimate." This study synthesised data through narrative synthesis employing thematic analysis (TA) (Regmi and Jones, 2020). Thematic Analysis is defined as "a method […] for identifying, analysing, and reporting patterns (themes)" or for seeking meaning within literature or data (Ritchie et al., 2003). In this study, we employed six steps to identify recurrent themes while synthesising data through thematic analysis: familiarising ourselves with the data, developing initial (sub) codes, searching for (sub) themes, reviewing (sub) themes, charting or compiling ideas or issues, and producing final data aligned with the study's aims and objectives (Ritchie et al., 2003; Regmi and Jones, 2020). Thereafter, a table was created to delineate the characteristics of the studies, including designs, techniques, and populations (see Table 2). Two researchers engaged in the processes and independently assessed each article, yielding an inter-rater reliability of 78% as determined by Cohen's kappa coefficient (Creswell and Poth, 2016; Salas-Pilco et al., 2022). Disputes were resolved by deliberation until a consensus was reached. Therefore, Petticrew and Roberts (2008) assert that this would enhance transparency by elucidating the types of data taken from various studies and acknowledging the contribution of each study to the overall synthesis.

TABLE 1 Inclusion and exclusion criteria.

Inclusion criteria	Exclusion criteria
E-learning implementation in higher education	Articles not published in peer-reviewed journals
Enablers and barriers of e-learning in higher education related to learning performance or outcomes	Articles beyond e-learning in higher education institutions
Articles that specifically offer empirical, primary research	Articles from secondary, non-empirical studies or grey literature, and with no full text
Articles were published in peer-reviewed journals in English after 2015	Letters, commentaries, review documents, discussion papers, posters, conference abstracts, congress reports, and dissertations
Articles that do not focus on e-learning during the COVID-19 pandemic	Articles focusing on e-learning during the COVID-19 pandemic

Following the PRISMA principles, 873 articles were identified from the four selected search engines, of which 212 were deemed suitable. An additional 38 duplicates were removed, leaving 174 papers available for abstract screening. Furthermore, a total of 103 articles were excluded for not meeting the highlighted inclusion criteria. After applying the inclusion and exclusion criteria, 71 articles were found to meet the requirements for further examination. However, upon closer inspection, it was determined that 50 articles were unrelated to the topic of this study. Ultimately, 21 publications were evaluated. A graphical representation is shown in Figure 1 below:

3 Results

Through thematic analysis of the collected studies, two overarching descriptive themes/categories were identified: enablers of e-learning and barriers to e-learning in higher education institutions, under which eight significant themes emerged (see Table 3).

Enablers of e-learning in higher education institutions

- Technological advancement
- Diverse learning resources
- Flexibility and accessibility
- Cost-effectiveness

TABLE 2 Demographic profile of studies included.

Characteristics	Studies included (%)
Research approach	
Qualitative approach	7 (33.3%)
Quantitative approach	6 (28.6%)
Mixed methods approach	8 (38.1%)
Year of publication	
2015–2018	4 (19.1%)
2019–2022	12 (57.1%)
2023–2025	5 (23.8%)
Continent/region	
Africa	5 (23.8%)
Asia	11 (52.3%)
Europe	3 (14.3%)
North and South America	1 (4.8%)
Oceania	1 (4.8%)
Study participants	
0–49	4 (19.0%)
50–99	1 (4.8%)
100–149	2 (9.5%)
150–199	0 (0%)
200–249	3 (14.3%)
250–299	1 (4.8%)
300–349	4 (19.0%)
350 and above	6 (28.6%)

Barriers to e-learning in the Higher Education Institutions

- Lack of motivation and self-discipline
- Technical issues
- Faculty resistance to change
- Inadequate technological infrastructure

4 E-learning enablers or drivers

4.1 Theme 1: technological advancement

Studies such as Naveed et al. (2017), West and Malatji (2021), and Garrad and Nolan (2023) have revealed that technological advancement is a crucial enabler of e-learning in higher education institutions by providing the necessary tools and infrastructure to facilitate online learning. The emergence of Learning Management Systems (LMS) such as Moodle, Blackboard, and Canvas allows educators to create, manage, and deliver online courses effectively (Mncube et al., 2021; Shurygin et al., 2021; Olawale, 2024; Hwang et al., 2020). These platforms offer a range of features, including the ability to host multimedia content, conduct assessments, and foster communication between students and instructors (Almarashdeh, 2016; Aladwan et al., 2018). Additionally, advancements in internet connectivity and the proliferation of mobile devices, such as smartphones and tablets, enhance accessibility, enabling students to engage with course materials anytime and anywhere (Farounbi, 2024; Rafiq et al., 2020; Aguilos and Fuchs, 2022; Garrad and Nolan, 2023). This flexibility supports diverse learning styles and schedules, making education more inclusive. Furthermore, technological innovations such as interactive simulations and gamification can improve student engagement and learning outcomes, thereby reinforcing the effectiveness of e-learning initiatives (Tuševljak et al., 2016; Aguilos and Fuchs, 2022). Therefore, integrating advanced technology streamlines the learning process and promotes collaboration and interaction among students from different geographical backgrounds, enriching the educational experience.

4.2 Theme 2: diverse learning resources

Studies such as Naveed et al. (2017), Alghizzawi et al. (2019), Rafiq et al. (2020), West and Malatji (2021), Aguilos and Fuchs (2022), Tymoshchuk (2022), Garrad and Nolan (2023), Saleem et al. (2023), and Tyagi and Krishankumar (2023) have reported that e-learning is a successful approach and tool that fosters student engagement in higher education institutions. Consequently, diverse learning resources play a crucial role as enablers of e-learning. They cater to various learning styles and preferences, allowing students to engage with the material in ways that best suit their individual needs (Aguilos and Fuchs, 2022; Innab et al., 2022; Rafiq et al., 2020). The availability of a wide range of resources, such as videos, articles, interactive quizzes, and forums, enhances the learning experience by providing multiple avenues for understanding and retaining information (Nyembe and Howard, 2019; Garrad and Nolan, 2023). This variety not only keeps students interested and motivated but also promotes deeper engagement with the content (Aguilos and Fuchs, 2022; Olawale, 2024). Furthermore, diverse resources can facilitate collaborative learning opportunities, connecting students from different backgrounds and locations, which enriches their educational experience (Anderson, 2005; Naveed et al., 2017; Alamri et al., 2021; Farounbi, 2024). Thus, by incorporating diverse learning resources, institutions can create a more inclusive and effective e-learning environment that supports student success and satisfaction.

4.3 Theme 3: flexibility and accessibility

Flexibility and accessibility are crucial enablers of e-learning in higher education institutions. The ability to learn anytime and anywhere allows students to tailor their educational experiences to fit their individual lifestyles and commitments (Torkzadeh et al., 2022; Garrad and Nolan, 2023; Simanjuntak and Sukresna, 2023; Tyagi and Krishankumar, 2023). This flexibility caters to diverse learning preferences, enabling students to engage with course materials at their own pace, which can enhance their overall learning experience (Ali et al., 2018; Tymoshchuk, 2022; Shisakha et al., 2024). Moreover, the widespread availability of technology, such as smartphones and tablets, increases accessibility to educational resources, making it possible for a larger audience to participate in e-learning. This is particularly important for students who may face geographical or time constraints (Tugwell and

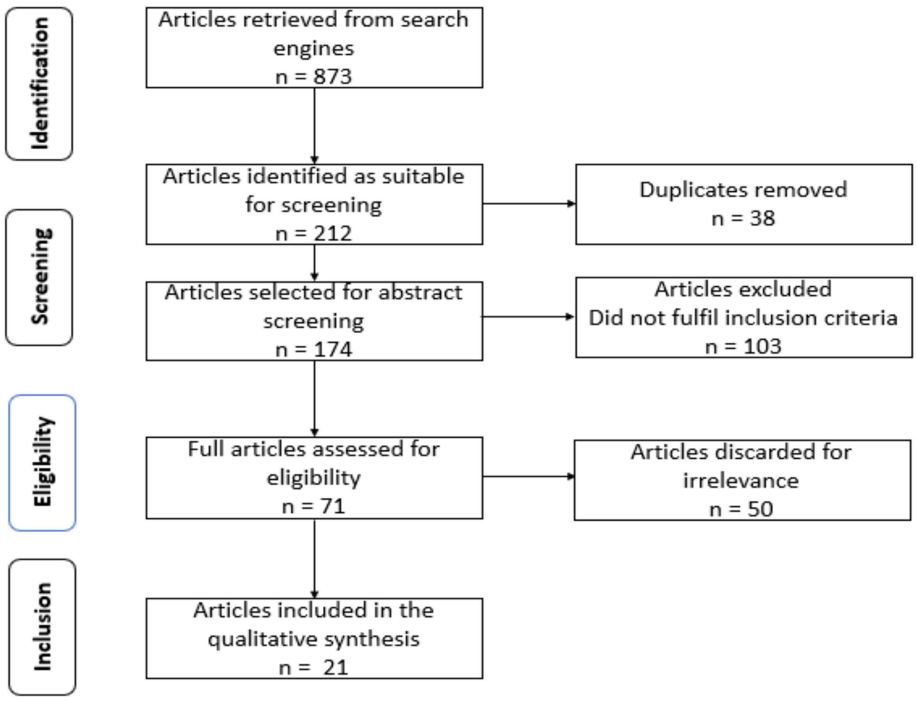

FIGURE 1
PRISMA flowchart showing results of the searches.

Maduabuchukwu, 2020; Deng and Sun, 2022), as they can access learning materials and engage in coursework without the limitations of traditional classroom settings (Aguilos and Fuchs, 2022; Tymoshchuk, 2022; Simanjuntak and Sukresna, 2023). The combination of flexibility and accessibility promotes self-paced learning and empowers students to take control of their educational journeys (Gunasinghe et al., 2020; Feliz et al., 2022). Thus, by providing a more inclusive and adaptable learning environment, higher education institutions can better meet the needs of their diverse student populations, ultimately leading to improved educational outcomes.

4.4 Theme 4: cost effectiveness

Cost-effectiveness is a significant enabler of e-learning in higher education institutions. Studies such as Ali et al. (2018), Torkzadeh et al. (2022), Simanjuntak and Sukresna (2023), and Abich and Eriku (2023) have revealed that by reducing the costs associated with physical infrastructure and commuting, e-learning provides a more affordable alternative to traditional education. Consequently, institutions can allocate resources more efficiently, allowing for investment in technology and content development that enhances the learning experience (Ali et al., 2018; Abich and Eriku, 2023). Furthermore, e-learning can cater to a broader audience, making education accessible to individuals who may not have the means to attend in-person classes (Wong and Looi, 2011; Aguilos and Fuchs, 2022). This flexibility benefits students and helps institutions remain competitive in a rapidly changing educational landscape (Abich and Eriku, 2023). Therefore, the cost-effectiveness of e-learning supports continuous education and skill development, making it a compelling option for both learners and educational institutions.

5 E-learning barriers or challenges

5.1 Theme 1: lack of motivation and self-discipline

The lack of motivation and self-discipline is a significant barrier to e-learning in higher education institutions. Studies such as Alghizzawi et al. (2019), Rafiq et al. (2020), Matarirano et al. (2021), Aguilos and Fuchs (2022), Feliz et al. (2022), and Tyagi and Krishankumar (2023) have revealed that in an online learning environment, students often have more autonomy over their schedules and learning pace, which can lead to challenges in maintaining focus and commitment. Without the structured environment of traditional classrooms, some learners may struggle to engage with the material consistently, resulting in decreased participation and poor academic performance. Additionally, the absence of regular face-to-face interactions with peers and instructors can contribute to feelings of isolation, further diminishing motivation (Matarirano et al., 2021; Saleem et al., 2023). The study by Saleem et al. (2023) indicated that a notable percentage of students reported difficulties in sustaining their motivation throughout the course, highlighting the importance of self-regulation in online education. To address this barrier, institutions can implement strategies that foster self-motivation, such as setting clear goals, providing timely feedback, and encouraging collaborative learning opportunities among students (Saleem et al., 2023; Tyagi and Krishankumar, 2023).

TABLE 3 Study characteristics and summary of the factors associated with e-learning.

Author, year, and country	Focus	Approach	Participants/ sample	E-learning challenges or barriers	E-learning enablers or drivers	Delivery mechanism	Key findings and implication
Garrad and Nolan (2023), Australia	Impact of universal design for learning (UDL) principles on student engagement, satisfaction, and retention in an undergraduate teacher education program.	The research employed a pre-test–post-test quasi-experimental design.	Data was collected from 107 students enrolled in a 4-year Bachelor of Education program at a regional Australian university.	High student attrition rates are attributed to poor course design, low levels of facilitation of learning, and ineffective student engagement. Challenges related to ensuring that all students, including those with disabilities and diverse socioeconomic backgrounds, have equitable access to digital resources and support.	Advancements in digital technologies allow for greater flexibility and accessibility in learning. Features such as customisable text options, multimedia resources, and text-to-speech capabilities enhance the learning experience for diverse learners. Implementing frameworks like Universal Design for Learning (UDL) supports proactive instructional design that maximises student access and engagement.	Universal design for learning in online studies	The research findings suggest that implementing universal design for learning (UDL) in an online higher education context positively impacts student engagement, satisfaction, and attrition rates. The findings advocate for the broader application of UDL principles beyond the School of Education, suggesting that replicating the study in different academic contexts could provide valuable comparative data. The research supports the notion that UDL can enhance the educational experience, promote inclusivity, and address student retention issues in higher education.
Tuševljak et al. (2016), Slovenia	Identify students' knowledge and perception of e-learning and their attitudes and experience with it, as well as assess their readiness to engage in e-learning and determine their willingness to pay for it.	The research employs a mixed methods methodology.	An online survey was administered to a larger sample of 104 respondents.	Concerns about the effectiveness of e-learning as a replacement for classic studying and the equivalency of online diplomas to traditional degrees. Additionally, there are obstacles related to integrating technology into the learning process, as some students may not be fully open to the idea of e-learning, preferring the structured environment of traditional classrooms.	Willingness to engage in online courses if they are designed effectively. The ability to repeat lectures and the potential for better time organisation are seen as significant advantages. Furthermore, the increasing global interest in implementing e-learning and the push for innovative educational approaches, such as gamification, can enhance student engagement and learning outcomes.	E-learning in higher education	The findings reveal that while students recognize the convenience and potential benefits of e-learning, there are reservations regarding its effectiveness compared to traditional learning. Institutions should address these concerns by ensuring that e-learning platforms are designed to enhance engagement and provide robust support for students, thereby improving their learning outcomes. The positive inclination of students towards e-learning suggests that educational institutions should consider expanding their online offerings. However, the preference for blended learning indicates that a hybrid approach, combining traditional methods with online components, may be more acceptable and effective for students.

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TABLE 3 (Continued)

Author, year, and country	Focus	Approach	Participants/ sample	E-learning challenges or barriers	E-learning enablers or drivers	Delivery mechanism	Key findings and implication
Alghizzawi et al. (2019), UAE	Effect of social media usage on students' e-learning acceptance in higher education.	The research employed a quantitative survey methodology	A sample of 480 graduate and undergraduate students.	Inadequate infrastructure, unreliable internet connectivity, and lack of access to necessary devices hinder the effectiveness of e-learning. Students and educator's resistance to adopting new technologies and methods, preferring traditional face-to-face learning. Struggle with self-discipline and motivation in an online learning environment, leading to lower engagement and completion rates.	E-learning allows students to learn at their own pace and on their own schedule, accommodating different learning styles and personal commitments. Provision of access to educational resources and courses for students who may not have been able to attend traditional classes due to geographical or physical constraints. E-learning platforms enhance engagement and facilitate student knowledge-sharing.	E-learning in higher education	The study supports the idea that social media features significantly enhance students' perceived usefulness (PU) and perceived ease of use (PE) of e-learning systems. This suggests that universities should consider incorporating social media functionalities into their e-learning platforms to improve user experience and acceptance. Secondly, the positive relationships identified between knowledge sharing, social media features, and motivation indicate that fostering a collaborative learning environment through social media can enhance student engagement and learning outcomes. Institutions may benefit from encouraging the use of social media for academic purposes, which could facilitate peer interactions and knowledge exchange among students.
Abich and Eriku (2023), Ethopia	Challenges and opportunities for the adoption of e-learning at the University of Gondar	The research employed a descriptive qualitative study design	A total of 31 participants were interviewed.	Technological challenges include inadequate ICT infrastructure, lack of technical skills among users, and insufficient technical support. Individual challenges involve varying levels of ICT knowledge among students and instructors, leading to a knowledge gap that affects the effective use of e-learning systems. Cultural challenges encompass resistance to new teaching methods and a lack of awareness about the advantages of e-learning. Course challenges include poor interface design and financial constraints.	Potential for flexible learning without time and place restrictions, which allows for better communication between faculty and students. The movement towards modernity and recognising that e-learning is a preferred teaching method can motivate stakeholders to adopt it. Additionally, the ability to upgrade skills and keep pace with global educational trends is a strong incentive for implementing e-learning systems.	E-learning adoption in higher education	The implications of the research findings highlight the significance of e-learning in the context of higher education in Ethiopia, particularly at the University of Gondar (UoG). The study provides valuable insights for various stakeholders, including faculty members, students, technical support staff, and policymakers. The findings emphasise the benefits of e-learning, such as flexibility, cost-effectiveness, and accessibility to resources, which can enhance the teaching and learning experience. Additionally, the research is a foundational resource for future studies and policy formulation regarding e-learning. It suggests that understanding the experiences and challenges university staff and students face can inform the development of more effective e-learning strategies and systems.

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TABLE 3 (Continued)

Author, year, and country	Focus	Approach	Participants/ sample	E-learning challenges or barriers	E-learning enablers or drivers	Delivery mechanism	Key findings and implication
Tyagi and Krishankumar (2023), India	Interactions of factors affecting e-learning adoption in higher education	The research employed a quantitative methodology.	The survey was distributed via email to 300 students, with an additional 50 links shared through WhatsApp.	Technical barriers involve issues related to technology access, system reliability, and network speed. Pedagogical issues arise from the need for effective instructional design and teaching strategies that engage students in an online environment. Learner engagement challenges stemming from a lack of motivation or interaction in virtual settings. Ethical concerns issues related to data privacy, academic integrity, and equitable access to resources.	Flexibility, which allows students to learn at their own pace and schedule. The widespread availability of smartphones and technology enhances accessibility, making e-learning more reachable to a larger audience. The quality of the e-learning system, including its usability, content quality, and support services, plays a crucial role in driving student engagement and satisfaction. E-learning improves the quality and effectiveness of education, especially during crises, and it also serves as a significant driver for its adoption in higher education institutions.	E-learning adoption in higher education	The study highlights the importance of understanding the complex interplay of multiple factors influencing learners' behavioural intention (BI) to adopt e-learning tools. By identifying eight key factors—performance expectancy, effort expectancy, hedonic motivation, system quality, information quality, service quality, digital literacy, and computer anxiety—, the study provides a comprehensive framework to guide HEIs in designing and implementing e-learning systems that cater to students' needs. The findings suggest that no single factor drives the adoption of e-learning; instead, combining these factors plays a crucial role. This insight emphasizes the need for HEIs to adopt a holistic approach when developing e-learning strategies, ensuring that they address multiple dimensions that affect students' perceptions and experiences.
Simanjuntak and Sukresna (2023), Indonesia	Role of adaptive e-learning co-design as main solution to higher education's marketing performance.	The research employed a mixed-method approach, integrating both qualitative and quantitative methods.	A total of 257 participants, including lecturers, higher education managers, and students.	Potential limitations in student engagement and difficulty adapting to new technologies for both lecturers and students. Additionally, issues such as time constraints, geographic limitations, affordability, and physical disabilities hinder effective e-learning experiences. There is also resistance to change from traditional teaching methods to more adaptive e-learning approaches.	The flexibility of accessing educational materials anytime and anywhere, the ability to reach a broader audience, and the provision of virtual laboratories and simulations that enhance learning experiences. E-learning also promotes self-paced education, empowering learners to take control of their learning processes. Integrating adaptive e-learning systems can reduce costs and improve learning outcomes, making it a compelling option for higher education institutions.	E-learning co-design in higher education	One of the key implications is that AEC fosters collaboration and interaction among lecturers, students, and education managers, which is essential for effective learning. This collaborative environment motivates students and helps them achieve specific academic goals consistently. Overall, the implications point to the necessity for HEIs to adopt AEC strategies to improve service performance, internationalisation efforts, and technology integration, ultimately leading to a more competitive and efficient educational environment. Institutions are encouraged to leverage these findings to enhance their educational offerings and foster a culture of collaboration and innovation among all stakeholders.

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TABLE 3 (Continued)

Author, year, and country	Focus	Approach	Participants/ sample	E-learning challenges or barriers	E-learning enablers or drivers	Delivery mechanism	Key findings and implication
Torkzadeh et al. (2022), Iran	Identify the components for evaluating the effectiveness of academic e-courses.	The methodology used in this research is a qualitative case study approach.	A total of 25 experts were selected.	Insufficient access to reliable internet and modern devices can hinder participation in e-learning. Some educators and students were reluctant to adopt new technologies or teaching methods, preferring traditional classroom settings. A lack of skills in using digital tools can prevent effective engagement with e-learning platforms. e-learning sometimes leads to feelings of isolation among students, reducing motivation and engagement. Evaluating student performance and understanding in an online environment can be more complex than in traditional settings.	E-learning allows students to access materials and complete coursework at their own pace and on their own schedule. Online platforms provide access to diverse learning materials and global expertise. E-learning reduces costs associated with physical infrastructure and commuting. Technology facilitates tailored learning paths that meet individual student needs. E-learning often incorporates various multimedia elements that can enhance the learning experience. E-learning supports continuous education and skill development, catering to a diverse audience.	E-learning in higher education	The identification of twelve components for assessing external effectiveness suggests that a comprehensive framework is necessary for evaluating e-learning programs. These components include productivity, flexibility, competitiveness, and lifelong learning, indicating that e-learning should focus on educational delivery and broader impacts on human resources and organisational goals. The study highlights the importance of interaction between external and internal effectiveness levels, suggesting that both dimensions are critical for a holistic evaluation. Overall, the implications point toward a more integrated approach to evaluating e-learning that considers educational quality and responsiveness to external demands.
Shahmoradi et al. (2018), Iran	Investigate the challenges of the e-learning system.	The methodology used in this research was a descriptive cross-sectional study.	A total of 300 students were selected.	E-learning challenges include issues related to access to technology, financial constraints, infrastructure deficiencies, and skill gaps among students. Many students face difficulties accessing the necessary technology and the internet, hindering their participation in e-learning programs. Cultural challenges affect communication and interaction in online learning environments, particularly for students from different backgrounds.	Immediate use of educational materials Encouragement from friends and peers Access to e-books and online resources Continuous online communication between teachers and students Effective policies and planning for e-learning implementation Development of targeted online courses that address educational, social, and cultural aspects Overcoming access, skill, and cultural challenges associated with e-learning systems.	E-learning in higher education	The study emphasises the importance of policies and guidelines to address potential issues arising during the implementation of e-learning systems. The implications of these findings underscore the necessity for a multi-faceted approach to improving e-learning systems. This includes enhancing access to technology, providing skill development opportunities, fostering a supportive online culture, and ensuring robust policy frameworks are in place. By addressing these areas, educational institutions can improve the effectiveness and success of e-learning initiatives, ultimately benefiting student learning outcomes.

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TABLE 3 (Continued)

Author, year, and country	Focus	Approach	Participants/ sample	E-learning challenges or barriers	E-learning enablers or drivers	Delivery mechanism	Key findings and implication
Shisakha et al. (2024), Kenya	Determining strategies that universities employ to enhance e-learning utilisation.	The research utilised a mixed-method design that incorporated both quantitative and qualitative research approaches.	12 Heads of department, 90 faculty members, 335 students, and 6 directors of distance and open electronic Learning (ODeL) programs were selected	Limited access to reliable internet or the latest devices prevents some people from participating in online learning. Online environments sometimes feel lonely or disconnected. Without face-to-face interaction, learners struggle to stay engaged. Not all learners are comfortable with technology. Some may find it difficult to navigate online platforms, which can create frustration and hinder learning.	E-learning offers the advantage of learning at one's own pace and on one's own schedule. This flexibility can make education more accessible for many individuals. Online learning provides access to many resources like videos, articles, and interactive simulations, which can enhance understanding and retention. E-learning allows learners to connect with educators and peers from around the world, expanding their perspectives and networking opportunities.	E-learning utilisation for instruction	Inadequacy of institutional resource capacity indicates that universities may struggle to provide effective e-learning experiences. This suggests a need for increased investment in infrastructure, such as reliable internet access and adequate computer resources, to support both faculty and students in their e-learning endeavours. Findings show that e-learning is not optimally utilised even when resources are available. This points to potential issues in training and support for faculty and the need for better integration of technology into teaching practices. The reluctance of some faculty members to adopt new technologies, as noted, underscores the importance of professional development and training programs to enhance technological proficiency among educators.
Okoye et al. (2023), Latin America	Impact of digital technologies on education	The research employed a mixed-methods approach, combining quantitative and qualitative methodologies.	The sample size was 874 participants.	Educators often do not have the necessary skills or training to use digital technologies for teaching and learning effectively. Many institutions face challenges related to inadequate technological infrastructure and insufficient resources to support e-learning initiatives. A significant number of students and educators lack reliable internet access, which hinders the effective implementation of e-learning programs. Many educators perceive the financial burden associated with licensing digital technologies or software as a barrier.	A significant percentage of HEIs recognise the increasing demand for digital technologies as a driver for adopting e-learning programs. Institutions acknowledge the importance of incorporating distance education and e-learning tools to meet contemporary educational needs. Some countries, such as Mexico, Chile, and Colombia, show a more favourable attitude towards adopting digital technologies, indicating the potential for growth in e-learning. There is a call for investment in world-class digital solutions to enhance educational opportunities for all students, regardless of their geographical location	Digital technologies in higher education	The significant differences identified among countries regarding the reach, barriers, and bottlenecks to the use of digital technologies suggest that educational policymakers and curriculum designers need to tailor their strategies to address the unique challenges faced by each country. This could involve developing targeted training programs for educators, improving infrastructure, and ensuring equitable access to technology. The study emphasises the importance of collaboration among various stakeholders, including educators, investors, and policymakers, to create a cohesive strategy for digital transformation in education. By leveraging the insights gained from this research, stakeholders can work together to build a more effective and inclusive educational ecosystem that meets the needs of all learners in the LATAM region.

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Author, year, and country	Focus	Approach	Participants/ sample	E-learning challenges or barriers	E-learning enablers or drivers	Delivery mechanism	Key findings and implication
Farounbi (2024), Nigeria	Identify the advantages and disadvantages of e-learning in higher education.	The methodology used in this research involved a mixed-methods approach, incorporating both quantitative and qualitative data collection and analysis.	The sample consisted of 100 students	Some common challenges include issues like technology limitations (e.g., not everyone has access to a good internet connection or the necessary devices), lack of interaction or engagement (students may feel isolated without face-to-face contact), and difficulties in staying motivated and organised (it's easy to get distracted when studying at home).	Interactive technology engages students more, and supportive online communities where learners can connect or well-structured courses that keep students organised and motivated. Effective online teaching also relies on the ability of educators to use technology well and create a welcoming learning environment.	E-Learning for Higher Education	The positive perception of e-learning among the majority of participants indicates that it can be an effective tool for knowledge transfer, potentially surpassing traditional teaching methods. This highlights the need for educational institutions to invest in and expand their e-learning offerings, ensuring that they are aligned with the latest technological developments and pedagogical strategies. Moreover, the study emphasizes the importance of student-centred evaluation techniques, which can enhance the learning experience by focusing on individual student needs and promoting self-directed learning. This approach could improve student engagement and performance, suggesting that educators adopt more personalized assessment methods in their e-learning frameworks.
Rafiq et al. (2020), Pakistan	Students' attitude towards the use of e-learning in higher education	The methodology used in this research involved a mixed-methods approach, combining quantitative and qualitative data collection methods.	The sample consisted of 2,160 students.	Some students may not have access to reliable internet or modern devices, which can make participating in online classes difficult. Online learning requires a high level of self-discipline. Without regular classroom interactions, some students may struggle to stay engaged. Not all online courses are created equal. Some may not be well-designed, making it hard for students to learn effectively.	E-learning often allows students to learn at their own pace and schedule, making balancing their studies with other commitments easier. Online platforms can provide a wealth of information and resources that students can use to supplement their learning. Features like discussion forums, video lectures, and interactive quizzes can help keep students engaged. E-learning enables students from around the world to learn together, promoting diverse interactions and ideas.	E-Learning in higher education	Firstly, the positive correlation between perceived usefulness and perceived ease of use suggests that enhancing these factors can significantly improve students' attitudes toward e-learning. Institutions should focus on creating user-friendly platforms that clearly demonstrate the benefits of e-learning to encourage greater acceptance among students. Secondly, the study emphasises the importance of external factors, such as pedagogical and technological elements, in shaping students' perceptions of e-learning. This indicates that universities must invest in both the technological infrastructure and the pedagogical strategies employed in online learning to maximise engagement and effectiveness. Additionally, the findings suggest that student engagement in e-learning is crucial for academic success. Therefore, institutions should implement strategies that promote active participation and interaction among students in online environments, as this can lead to improved academic performance.

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TABLE 3 (Continued)

Author, year, and country	Focus	Approach	Participants/ sample	E-learning challenges or barriers	E-learning enablers or drivers	Delivery mechanism	Key findings and implication
Saleem et al. (2023), Pakistan	Expectations and experiences of medical students regarding use of e-learning resources in higher education	The methodology used in this research involved a quantitative cross-sectional study design.	A pre-validated questionnaire was employed to collect data from a total of 300 medical undergraduate students.	A significant portion of students reported frequently encountering technical issues, such as software errors and slow internet access, which can hinder their learning experience. Challenges in maintaining motivation throughout the course indicate that self-motivation can be a barrier in an online learning environment. Students in e-learning settings face additional assignments that require them to create well-structured learning materials, which can be overwhelming.	High percentage of students recognised their instructors' expertise in implementing e-learning courses, which contributes positively to their learning experience. An overwhelming majority appreciated the prompt feedback provided by instructors through various communication channels, enhancing their learning process. A significant proportion of students found the learning environment user-friendly, facilitating easier navigation and engagement. A vast majority of students felt that the learning environment offered ample opportunities to enhance their knowledge, indicating a strong driver for engagement.	E-learning resources in higher education	The results indicate that students view the instructor's support, feedback, and expertise as crucial factors contributing to their learning accomplishments and satisfaction with the course. This suggests that instructors should be trained in the subject matter and ineffective e-learning strategies to enhance student engagement and motivation. The study underscores the importance of a well-structured and organised course. A clear course outline and accessible learning materials are essential for facilitating student learning. This implies that course designers should prioritise clarity and organisation when developing e-learning content to ensure that students can navigate the material effectively. Lastly, the study suggests that fostering self-regulated and collaborative learning opportunities can lead to higher learning achievements. Educators should create environments encouraging students to take initiative in their learning, work together, and share knowledge, which can enhance their overall educational experience.
Ali et al. (2018), Pakistan	University students' acceptance of e-learning systems	The research methodology employed in this study involved a non-probability sampling technique	A total of 440 questionnaires were distributed	Students' academic efficiency may decline if the e-learning system is not fully utilised. Online courses experience greater dropout rates compared to traditional face-to-face courses. Acceptance or rejection of technology. A lack of user-friendly applications, high-speed internet, updated IT labs, and qualified staff.	E-learning provides students with the flexibility to improve their academic performance and learning experience. E-learning can reduce costs associated with traditional education methods. E-learning allows students from various locations to access educational resources and courses.	E-learning system in higher education institutes	From a theoretical perspective, the study contributes to understanding the technology acceptance model (TAM) by incorporating new constructs that influence user acceptance. It highlights the importance of variables such as work-life quality (WLQ), facilitating conditions (FC), and others in shaping students' behavioural intentions (BI) and actual usage (AU) of e-learning platforms. This extension of TAM provides a more comprehensive framework for analysing technology acceptance, particularly in the context of e-learning in Pakistan. The findings suggest that educational institutions should focus on improving the identified factors significantly impacting students' acceptance of e-learning systems. This implies that universities should invest in resources and support systems that create a conducive learning environment.

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Author, year, and country	Focus	Approach	Participants/ sample	E-learning challenges or barriers	E-learning enablers or drivers	Delivery mechanism	Key findings and implication
Matarirano et al. (2021), South Africa	ICT platforms and approaches used by lecturers during remote teaching	The research employed a quantitative explanatory design.	A total of 244 respondent	Challenges in e-learning include issues like lack of internet access, inadequate technical skills among learners and instructors, and feelings of isolation because students may miss the social interaction that comes with in-person learning. These barriers can prevent people from taking full advantage of online learning.	This includes the availability of user-friendly technology, strong support systems (like tutoring or mentoring), and motivation from both educators and learners to succeed in an online environment.	Multi-Modal Emergency Remote Teaching at Higher Education Institution	The positive causal effects of age and study level on technology readiness suggest that older students and those at higher academic levels are better prepared for technology-enhanced learning environments. This implies that educational institutions may need to tailor their technological support and training programs to better accommodate younger students and those in lower study levels, who may be less prepared for such environments. Furthermore, the findings underscore the need for continuous assessment and adaptation of educational practices to ensure that all students, regardless of age or gender, receive adequate support in developing their technological skills. Institutions may benefit from implementing targeted interventions, such as workshops or mentorship programs, to bridge the readiness gap for younger and less experienced students.
West and Malatji (2021), South Africa	Use of website design pedagogy to promote quality teaching and learning	The research employed an embedded mixed-method research design.	Resulting in 214 participants.	These issues can include things like access to technology, learning styles, and the quality of the courses themselves.	These can include strong internet connections, user-friendly platforms, supportive educators, and engaging learning materials.	Technology integration in higher education	The positive feedback from pre-service teachers regarding their increased pedagogical knowledge (PK), content knowledge (CK), and technological knowledge (TK) suggests that assignments designed to challenge students can effectively enhance their preparedness for modern classrooms. This indicates that educators should focus on creating assignments that incorporate technology and require critical thinking and reflection, thereby facilitating deeper learning experiences. The implications of the research findings advocate for a balanced approach to technology integration in higher education, emphasising the importance of supportive learning environments, effective training for educators, and addressing equity issues to ensure that all students can benefit from technological advancements in their education.

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TABLE 3 (Continued)

Author, year, and country	Focus	Approach	Participants/ sample	E-learning challenges or barriers	E-learning enablers or drivers	Delivery mechanism	Key findings and implication
Naveed et al. (2017), Saudi Arabia	Identify critical success factors (CSFs) and validate them for successful implementation of e-leaning.	The methodology used in this research involved a mixed-method approach.	A survey was administered to 247 staff members from different universities.	Lack of access to technology, inadequate internet connectivity, and limited digital literacy among users. For example, if someone does not have a reliable computer or internet connection, they may struggle to participate in online courses. Additionally, if someone is unfamiliar with digital tools, they may find it hard to engage with the learning material.	Improved technology, supportive learning environments, and effective instructional design. For instance, advancements in broadband internet can help more people access e-learning, and well-designed courses can enhance student engagement and understanding.	E-learning in higher education	Firstly, the study underscores the significance of user training as a crucial factor, with the highest mean value of 3.74. This suggests that institutions should prioritize comprehensive training programs for users, including both students and faculty, to ensure they are well-equipped to utilise E-Learning systems effectively. This training can enhance user confidence and competence, ultimately leading to better engagement and learning outcomes. The implications of this research suggest that higher education institutions must adopt a comprehensive approach to E-Learning implementation, focusing on training, infrastructure, content design, ethical considerations, student engagement, and a multi-dimensional strategy to enhance the overall effectiveness of e-learning systems.
Feliz et al. (2022), Spain	Analyse and discover the ability of HE students to use the physical home context for e-learning via ICT.	The research employed a qualitative methodology.	The sample consisted of 220 photographs provided by 60 students.	Challenges to e-learning include factors like lack of technology, poor internet connectivity, or a lack of motivation among learners. These challenges can make it difficult for students to participate in e-learning or get the most out of it. For example, if a student does not have access to a reliable computer or high-speed internet, they may struggle to keep up with their coursework. Additionally, some students may find it hard to focus or stay self-motivated without the structure of a traditional classroom.	On the other hand, enablers or drivers are elements that help make e-learning effective. These might involve the availability of user-friendly technology, strong online support systems, or engaging and interactive content that keeps students interested. For instance, if an e-learning platform offers easy access to tutorials and quizzes, students may find it easier to learn and succeed. Furthermore, flexible scheduling allows students to study at their own pace, which can enhance their learning experience.	E-learning in higher education	The study highlights the importance of design and spatial organisation in creating effective academic spaces at home. This suggests that students who are more design-conscious may have better strategies for transforming their living spaces into conducive learning environments, which could influence their academic performance and overall well-being. The results also indicate that there is a complex interplay between various elements in the home environment, with certain items and colours being preferred in specific spaces. This knowledge can be leveraged by educators and designers to create resources or guidelines that help students optimise their study environments.

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TABLE 3 (Continued)

Author, year, and country	Focus	Approach	Participants/ sample	E-learning challenges or barriers	E-learning enablers or drivers	Delivery mechanism	Key findings and implication
Gunasinghe et al. (2020), Sri Lanka	Adequacy of unified theory of acceptance and use of technology-3 (UTAUT-3) model in understanding academician's adoption to e-learning.	The research employed a quantitative survey methodology	A sample of 441 records was selected	Problems such as software glitches, slow internet connections, or lack of technical skills disrupt the e-learning experience. Compared to a traditional classroom setting, learners struggle to stay motivated or engaged when studying alone online. The absence of face-to-face interaction can make learning feel isolating. Not all online courses are created equal. Some may lack proper structure, support, or engaging materials, which can lead to a poor learning experience.	E-learning allows learners to study at their own pace and on their own schedule, making it easier to fit education into their busy lives. Online platforms can provide a wide range of materials, from videos and articles to interactive quizzes and forums, catering to different learning styles. E-learning connects learners worldwide, offering opportunities for collaboration and idea exchange that might not be available in traditional classrooms. Many online courses are more affordable than traditional education options, making learning accessible to a broader audience.	E-learning in higher education environments	The findings imply that if e-learning is perceived as more beneficial than traditional teaching methods, academicians will likely increase its usage. Therefore, HE administration should actively communicate the advantages of e-learning, ensuring that faculty members understand how it can enhance their teaching and improve student outcomes. Continuous reminders about these benefits can help maintain engagement and encourage adoption. Overall, the findings emphasise the need for HEIs to create a supportive environment that fosters the adoption of e-learning through effective communication, training, and resource availability. By addressing the identified determinants of behavioural intention, institutions can enhance the likelihood of successful e-learning implementation and ultimately improve educational delivery.
Aguilos and Fuchs (2022), Thailand	Usefulness and challenges of gamified learning in the context of a massive open online course	The research employed a qualitative methodology	A total of 19 undergraduate students	Lack of motivation, insufficient support, and accessibility problems. For instance, if a student does not have a reliable internet connection, they may struggle to participate in online classes.	Effective teaching strategies, access to resources and technology, student engagement, and strong support systems. For example, if a course is designed to be interactive and engaging, students might find it easier to learn and remain motivated.	Gamified e-learning	The study underscores the importance of thoughtful course design and the integration of game elements tailored to students' needs and preferences. It suggests that educators should consider the diversity of student motivation and engagement levels when incorporating gamification into their courses. Additionally, the results indicate a need for further research to identify which specific game elements are most effective and how they can be utilised to engage less motivated students. Overall, the implications point to the necessity of a nuanced approach to gamification in education, recognising that its effectiveness can vary widely among different student populations.

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TABLE 3 (Continued)

Author, year, and country	Focus	Approach	Participants/ sample	E-learning challenges or barriers	E-learning enablers or drivers	Delivery mechanism	Key findings and implication
Tymoshchuk (2022), Ukraine	E-learning contribution to effective foreign language learning	The methodology used in this research involved a quantitative approach, Google Forms.	The total number of participants was 35	Learners have limited access to the internet, lack technical skills, or struggle to stay motivated without face-to-face interaction. These barriers can make it hard for them to complete their courses or gain the knowledge they need.	Better technology, effective instructional designs, and supportive environments. For instance, when schools and organisations invest in high-quality online platforms and provide training for both teachers and students, it can lead to a more effective e-learning experience.	E-learning in higher education	Moreover, the significant percentage of respondents who appreciated the flexibility of e-learning—being able to learn anytime and anywhere—highlights the need for educational institutions to adopt more flexible learning models. This flexibility can cater to diverse learning preferences and lifestyles, making education more accessible and appealing to students. Additionally, the high level of satisfaction with e-learning among respondents implies that institutions should continue to invest in and improve their e-learning platforms and resources. This investment can lead to better educational outcomes and more effective language acquisition.

5.2 Theme 2: technical issues

Studies such as Gunasinghe et al. (2020), Matarirano et al. (2021), Tymoshchuk (2022), Abich and Eriku (2023), Saleem et al. (2023), and Tyagi and Krishankumar (2023) have revealed that technical issues are significant barriers to the effective implementation of e-learning in higher education institutions. These issues can manifest in various forms, including inadequate access to technology, unreliable internet connectivity, and problems with system reliability. Many students may lack the necessary devices or face difficulties with network speed, which can hinder their ability to participate in online courses (Matarirano et al., 2021; Saleem et al., 2023). Additionally, technical barriers can arise from the complexity of e-learning platforms, leading to frustration among both students and faculty (Ali et al., 2018; Gunasinghe et al., 2020; Aguilos and Fuchs, 2022). Faculty members may also resist adopting new technologies due to unfamiliarity or discomfort with the digital tools required for e-learning (Abich and Eriku, 2023). These technical challenges can impede learner engagement, reduce the quality of the educational experience, and exacerbate existing inequalities in access to education. Therefore, addressing these technical barriers is crucial for enhancing the effectiveness and success of e-learning initiatives in higher education.

5.3 Theme 3: faculty resistance to change

Studies such as those by Alghizzawi et al. (2019), Abich and Eriku (2023), and Simanjuntak and Sukresna (2023), have revealed that faculty resistance to change is a significant barrier in higher education institutions, particularly when transitioning from traditional teaching methods to more adaptive e-learning approaches. This resistance can stem from various factors, including a lack of familiarity with new technologies, comfort with established teaching practices, and concerns about the effectiveness of e-learning compared to face-to-face instruction. Faculty members may also fear that adopting new methods could undermine their authority or expertise in the classroom. Such reluctance can hinder the integration of innovative teaching strategies and technologies, ultimately affecting the overall quality of education and student engagement (Abich and Eriku, 2023; Simanjuntak and Sukresna, 2023). To address this barrier, institutions must prioritise professional development and training programmes that enhance faculty technological proficiency and demonstrate the benefits of e-learning (Alghizzawi et al., 2019). Encouraging a culture of collaboration and innovation among faculty can also help mitigate resistance and foster a more supportive environment for the adoption of e-learning initiatives.

5.4 Theme 4: inadequate technological infrastructure

Inadequate technological infrastructure is a significant barrier to the effective implementation of e-learning in higher education. Studies such as Shahmoradi et al. (2018), Alghizzawi et al. (2019), Abich and Eriku (2023), and Okoye et al. (2023), reveal that many institutions struggle to provide the necessary resources, such as reliable internet access and modern devices, which are crucial for both students and

educators to engage with online learning platforms. This lack of infrastructure can lead to difficulties in accessing course materials, participating in online discussions, and completing assignments, ultimately hindering students' learning experiences (Alghizzawi et al., 2019; Okoye et al., 2023). Additionally, insufficient support for faculty in utilising digital technologies can further exacerbate the challenges faced in adopting e-learning approaches (Shahmoradi et al., 2018; Abich and Eriku, 2023). Thus, without adequate investment in technological infrastructure, the potential benefits of e-learning, such as flexibility, accessibility, and cost-effectiveness, may not be fully realised, leading to disparities in educational opportunities among students from different socio-economic backgrounds.

6 Discussion

Technological advancement plays a crucial role in enabling e-learning in higher education institutions. The rapid development of digital tools and platforms has allowed students and educators to engage in interactive and immersive learning experiences. Technologies such as learning management systems, virtual classrooms, and multimedia resources facilitate the delivery of content and enhance student engagement (Violante and Vezzetti, 2015; Yurdugül and Çetin, 2015; Almarashdeh, 2016; Rafiq et al., 2020). This advancement not only improves the quality of education but also makes it more appealing to a tech-savvy generation of learners (Alghizzawi et al., 2019; Saleem et al., 2023; Tyagi and Krishankumar, 2023). Moreover, the availability of a wide range of educational materials, including videos, articles, e-books, and interactive quizzes, caters to different learning styles and preferences which enriches the educational landscape (Tuševljak et al., 2016; Alghizzawi et al., 2019; West and Malatji, 2021; Garrad and Nolan, 2023). These resources empower students to take ownership of their learning journeys, encouraging exploration and critical thinking. Furthermore, this variety of materials allows students to select resources that best fit their individual needs, promoting a more personalised learning experience (Rafiq et al., 2020; Saleem et al., 2023). Thus, democratising information access reinforces the idea that education must be inclusive, enabling learners from diverse backgrounds to utilize high-quality resources that were once unattainable (Mncube et al., 2021; Shurygin et al., 2021; Olawale, 2024). The study findings also revealed that flexibility and accessibility are essential elements of e-learning, catering to the varied requirements of the contemporary student demographic for the effectiveness of higher education institutions (Ali et al., 2018; Tymoshchuk, 2022; Simanjuntak and Sukresna, 2023). The capacity to learn independently and according to a personal timetable accommodates diverse obligations, therefore diminishing obstacles to education (Tugwell and Maduabuchukwu, 2020; Shisakha et al., 2024). Also, the ability to access educational materials anytime and anywhere eradicates geographical barriers and allows for a more inclusive learning environment (Khan et al., 2017; Aladwan et al., 2018). This flexibility accommodates diverse lifestyles and empowers students to take control of their learning processes. Furthermore, the cost-effectiveness of e-learning models presents a compelling argument for their adoption. By reducing overhead costs associated with physical infrastructure and offering scalable solutions, institutions can allocate resources more efficiently (Tymoshchuk, 2022; Tugwell and Maduabuchukwu, 2020; Simanjuntak and Sukresna, 2023; Tyagi and Krishankumar, 2023). This financial viability not only supports institutional sustainability but also makes higher education more attainable for a wider audience. Thus, the interaction of these linkages between above above-discussed enablers highlights the transformational capacity of e-learning in higher education. By leveraging technology, diverse resources, flexibility, and cost-effectiveness, institutions can create a more inclusive and effective educational environment that meets the needs of today's learners.

This study's findings further highlight the intricate relationship among motivating variables, technical preparedness, and institutional culture in determining the efficacy of e-learning in higher education. The review indicates that insufficient motivation and self-discipline frequently arise from a disparity between conventional teaching methods and the requirements of a digital learning context. This lack of motivation and self-discipline significantly hinders students' engagement in e-learning (Tuševljak et al., 2016; Rafiq et al., 2020; Feliz et al., 2022; Abich and Eriku, 2023). This disconnection may result in disengagement, thereby impeding the potential advantages of e-learning. As such, the lack of intrinsic motivation can be compounded by external issues, including insufficient support systems and unclear information about the benefits of e-learning. Furthermore, technical challenges, such as erratic internet connectivity and faulty learning management systems, exacerbate the e-learning environment, making it difficult for students to participate fully in online courses (Gunasinghe et al., 2020; Tymoshchuk, 2022). Faculty members, used to in-person interactions, may frequently exhibit mistrust regarding e-learning methodologies, apprehensive that these approaches may undermine educational quality (Abich and Eriku, 2023; Simanjuntak and Sukresna, 2023). This reluctance can establish a cyclical impediment; without teacher endorsement, students are less inclined to participate substantively with e-learning platforms, leading to subpar educational results. Also, findings revealed that inadequate support for faculty members in employing digital technology can intensify the difficulties encountered in implementing e-learning (Shahmoradi et al., 2018; Abich and Eriku, 2023; Okoye et al., 2023). Insufficient technology infrastructure within institutions acts as a fundamental catalyst for these difficulties (Shahmoradi et al., 2018; Matarirano et al., 2021). Institutions that neglect to invest in substantial technology resources may unintentionally convey to educators and students that e-learning is a subordinate concern. The absence of investment may foster a culture of indifference towards e-learning initiatives, hence sustaining disengagement and resistance. Therefore, tackling these interconnected difficulties necessitates a comprehensive strategy that emphasizes motivation, improved technical assistance, and the cultivation of a culture of creativity among academics. Only through comprehensive strategies can higher education institutions effectively leverage e-learning to enhance the educational experience.

7 Conclusion

This systematic review highlighted essential enablers and barriers of e-learning in the higher education institutions. Identified key enablers are technology innovation, diversified learning materials, cost-effectiveness, flexibility, and accessibility. These elements jointly improve the educational experience, creating an atmosphere favorable to learning and engagement. In contrast, the highlighted barriers—namely,

faculty resistance to change, insufficient technological infrastructure, lack of desire and self-discipline among students, and technical difficulties—present considerable hurdles that may obstruct the successful integration of technology in education. The results obtained from this review have significant implications for interventions and policy development. By identifying the facilitators, educational institutions may strategically allocate resources towards technology innovations and varied learning materials that enhance engagement and accessibility. Moreover, overcoming obstacles, especially faculty opposition and insufficient infrastructure, is essential for cultivating a flexible educational environment. This review, therefore, emphasizes the need for customized professional development programs designed to educate educators with the skills and motivation required to adopt technology advancements. The findings enhance current research by offering a nuanced comprehension of the interaction between facilitators and obstacles in the incorporation of educational technology. These insights can assist educational leaders in formulating strategic initiatives that utilize technology breakthroughs while addressing resistance and infrastructure obstacles. The social ramifications are substantial; improving accessibility and flexibility via technology may democratize education, rendering it more accessible for many communities. It is crucial to recognize the limits of this research, including possible biases in the examined studies and the dynamic nature of educational technology. Future studies should, therefore, investigate the long-term effects and efficacy of certain remedies across varied institutional settings to enhance these findings. This review serves as a fundamental reference for those seeking to navigate the intricacies of technology integration in education.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

BEO: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Validation, Writing – original draft, Writing – review & editing. BIO: Supervision, Validation, Writing – review & editing. KS: Investigation, Supervision, Validation, Writing – review & editing.

Funding

The author(s) declare that no financial support was received for the research and/or publication of this article.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The authors declare that no Gen AI was used in the creation of this manuscript.

Publisher's note

References

Abd-Elsayed, A., Botros, M., Huynh, P., and Lawrence, J. P. (2015). E-learning, distance learning. Online learning in the setting of medical education, a review of current literature. *J. Clin. Anesth. Manag.* 1, 1–16. doi: 10.16966/2470-9956.102

Abich, Y., and Eriku, G. A. Challenges and opportunities for the adoption of e-learning at the University of Gondar: a qualitative study. E-learning working paper series, (2023), 1, 1–21. doi: 10.14507/MCF-eLi.I6

Aguilos, V., and Fuchs, K. (2022). The perceived usefulness of gamified e-learning: a study of undergraduate students with implications for higher education. *Front. Educ.* 1, 1–11. doi: 10.3389/feduc.2022.945536

Al Rawashdeh, A. Z., Mohammed, E. Y., Al Arab, A. R., Alara, M., and Al-Rawashdeh, B. (2021). Advantages and disadvantages of using e-learning in university education: analyzing students' perspectives. *Electron. J. E-Learn.* 19, 107–117. doi: 10.34190/ejel.19.3.2168

Aladwan, F., Al-Shboul, M., and Al Awamrah, A. (2018). Distance education, blended learning, and e-learning predictions and possibilities. *Mod. Appl. Sci.* 13, 192–206. doi: 10.5539/mas.v13n2p192

Alamri, H. A., Watson, S., and Watson, W. (2021). Learning technology models that support personalization within blended learning environments in higher education. *TechTrends* 65, 62–78. doi: 10.1007/s11528-020-00530-3

Alghizzawi, M., Habes, M., Salloum, S. A., Ghani, M. A., Mhamdi, C., and Shaalan, K. (2019). The effect of social media usage on students' e-learning acceptance in higher education: a case study from the United Arab Emirates. *Int. J. Inf. Technol. Lang. Stud.* 3, 13–26.

Ali, M., Raza, S. A., Qazi, W., and Puah, C. H. (2018). Assessing e-learning system in higher education institutes: evidence from structural equation modelling. *Interact. Technol. Smart Educ.* 15, 59–78. doi: 10.1108/ITSE-02-2017-0012

Almarashdeh, I. (2016). Sharing instructors experience of learning management system: a technology perspective of user satisfaction in distance learning course. *Comput. Hum. Behav. 63*, 249–255. doi: 10.1016/j.chb.2016.05.013

Alnemrat, A., Aldamen, H., Al-Deaibes, M., and Alsharefeen, R. (2023). E-learning in a Jordanian higher education institution. *Front. Psychol.* 14:1136142. doi: 10.3389/fpsyg.2023.1136142

Anderson, J. (2005). IT, e-learning, and teacher development. *Int. Educ. J.* 5, 1–14.

Anderson, T. (2017). How communities of inquiry drive teaching and learning in the digital age. *North Contact* 1, 1–6.

Bates, A. T., and Sangra, A. (2011). Managing technology in higher education: strategies for transforming teaching and learning. New Jersey: John Wiley and Sons.

Boland, A., Cherry, M. G., and Dickson, R. (2023). Doing a systematic review: a student's guide. Washington DC: SAGE.

Chen, C. C., and Swan, K. (2020). Using innovative and scientifically-based debate to build e-learning community. *Online Learn.* 24, 67–80. doi: 10.24059/olj.v24i3.2345

Clarke, M. (2007). *Overview of methods. Reviewing research evidence for nursing practice: Systematic reviews*. (Eds.) W. Christine and R. Brenda. Oxford: Blackwell Publishing. doi: 10.1002/9780470692127.ch1

Creswell, J. W., and Poth, C. N. (2016). Qualitative inquiry and research design: choosing among five approaches. New York: Sage Publications.

Cullen, R. (2001). Addressing the digital divide. *Online Inf. Rev.* 25, 311–320. doi: 10.1108/14684520110410517

Daultani, Y., Goswami, M., Kumar, A., and Pratap, S. (2021). Perceived outcomes of e-learning: identifying key attributes affecting user satisfaction in higher education institutes. *Meas. Bus. Excell.* 25, 216–229. doi: 10.1108/MBE-07-2020-0110

Deng, X., and Sun, R. (2022). Barriers to e-learning during crisis: a capital theory perspective on academic adversity. *J. Inf. Syst. Educ.* 33, 75–84.

Dickson, R. (2017). Doing a systematic review—a students guide. Washington DC: Sage Publications Limited.

Farounbi, T. T. (2024). Assessing the use of e-learning for higher education: a cross-sectional study of Nigerian students' perspectives. *Int. J. Learn. Dev.* 14, 88–104. doi: 10.5296/ijld.v14i1.21631

Feliz, S., Ricoy, M. C., Buedo, J. A., and Feliz-Murias, T. (2022). Students' e-learning domestic space in higher education in the new normal. *Sustainability* 14, 1–16. doi: 10.3390/su14137787

Garrad, T. A., and Nolan, H. (2023). Rethinking higher education unit design: embedding universal design for learning in online studies. *Student Success* 14, 1–8.

Garrison, D. R., and Akyol, Z. (2015). Toward the development of a metacognition construct for communities of inquiry. *Internet High. Educ.* 24, 66–71. doi: 10.1016/j.iheduc.2014.10.001

Ghobadi, S., and Ghobadi, Z. (2015). How access gaps interact and shape digital divide: a cognitive investigation. *Behav. Inf. Technol.* 34, 330–340. doi: 10.1080/0144929X.2013.833650

Gligorea, I., Cioca, M., Oancea, R., Gorski, A. T., Gorski, H., and Tudorache, P. (2023). Adaptive learning using artificial intelligence in e-learning: a literature review. *Educ. Sci.* 13, 1216–1223. doi: 10.3390/educsci13121216

Gunasinghe, A., Hamid, J. A., Khatibi, A., and Azam, S. F. (2020). The adequacy of UTAUT-3 in interpreting academician's adoption to e-learning in higher education environments. *Interact. Technol. Smart Educ.* 17, 86–106. doi: 10.1108/ITSE-05-2019-0020

Hung, I. C., and Chen, N. S. (2018). Embodied interactive video lectures for improving learning comprehension and retention. *Comput. Educ.* 117, 116–131. doi: 10.1016/j.compedu.2017.10.005

Hwang, G. J., Sung, H. Y., Chang, S. C., and Huang, X. C. (2020). A fuzzy expert system-based adaptive learning approach to improving students' learning performances by considering affective and cognitive factors. *Comput. Educ. Artif. Intell.* 1, 100003–100015. doi: 10.1016/j.caeai.2020.100003

Innab, A., Albloushi, M., Alruwaili, M., Alqahtani, N., Alenazi, L., and Alkathiri, A. (2022). The influence of sense of community and satisfaction with e-learning and their impact on nursing students' academic achievement. *Int. Rev. Res. Open Distance Learn.* 23, 19–34. doi: 10.19173/irrodl.v23i4.6436

Karnatak, H., Raju, P. L., Krishnamurthy, Y. V., and Senthil Kumar, A. (2015). E-learning based capacity building in geoinformatics. *ISG* 21, 4–13.

Khan, B. H. (2015). Introduction to e-learning. England, UK: Routledge.

Khan, A., Egbue, O., Palkie, B., and Madden, J. (2017). Active learning: engaging students to maximize learning in an online course. *Electron. J. e-Learn.* 15, 107–115.

Kmet, L. M., Cook, L. S., and Lee, R. C. (2004). Standard quality assessment criteria for evaluating primary research papers from a variety of fields. Alberta: Alberta Heritage Foundation for Medical Research Edmonton.

Kumar Basak, S., Wotto, M., and Bélanger, P. (2018). E-learning, M-learning and D-learning: conceptual definition and comparative analysis. *E-learn. Digit. Media 15*, 191–216. doi: 10.1177/2042753018785180

Matarirano, O., Yeboah, A., and Gqokonqana, O. (2021). Readiness of students for multi-modal emergency remote teaching at a selected South African higher education institution. *Int. J. High. Educ.* 10, 135–152. doi: 10.5430/ijhe.v10n6p135

Mayer, R. E. (2017). Using multimedia for e-learning. *J. Comput. Assist. Learn.* 33, 403–423. doi: 10.1111/jcal.12197

Means, B., Toyama, Y., Murphy, R., Bakia, M., and Jones, K. (2010). Evaluation of evidence-based practices in online learning: a meta-analysis and review of online learning studies center for technology in learning. Jessup, MD, USA: US Department of Education.

Mncube, V., Olawale, B. E., and Bitso, C. (2021) Democratisation of knowledge through open educational resources: opportunities and challenges at a South African University. Global Education Network 2021. South Africa

Moher, D., Liberati, A., Tetzlaff, J., and Altman, D. G.Prisma Group (2010). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Int. J. Surg.* 8, 336–341. doi: 10.1016/j.ijsu.2010.02.007

Mukhlisa, H. H. (2024). Connectivism and digital age education: insights, challenges, and future directions. *Kasetsart J. Soc. Sci.* 45, 1–13. doi: 10.34044/j.kjss.2024.45.3.11

Mutongoza, B. H., and Olawale, B. E. (2022). Safeguarding academic integrity in the face of emergency remote teaching and learning in developing countries. *Perspect. Educ.* 40, 234–249. doi: 10.18820/2519593X/pie.v40.i1.14

Naveed, Q. N., Muhammad, A., Sanober, S., Qureshi, M. R., and Shah, A. (2017). A mixed method study for investigating critical success factors (CSFs) of e-learning in Saudi Arabian Universities. *Methods* 8, 171–178. doi: 10.14569/IJACSA.2017.080522

Nyembe, B. Z., and Howard, G. R. (2019). The utilities of prominent learning theories for mobile collaborative learning (MCL) with reference to WhatsApp and m-learning. International conference on advances in big data, computing and data communication systems (icABCD). KwaZulu Natal, South Africa.

Okoye, K., Hussein, H., Arrona-Palacios, A., Quintero, H. N., Ortega, L. O., Sanchez, A. L., et al. (2023). Impact of digital technologies upon teaching and learning in higher education in Latin America: an outlook on the reach, barriers, and bottlenecks. *Educ. Inf. Technol.* 28, 2291–2360. doi: 10.1007/s10639-022-11214-1

Olawale, B. (2024). Collaborative virtual environments (CVEs) in the preparation of pre-service mathematics teachers. *J. Learn. Teach. Digit. Age* 9, 55–63. doi: 10.53850/joltida.1359772

Ottenbreit-Leftwich, A. T., Glazewski, K. D., Newby, T. J., and Ertmer, P. A. (2010). Teacher value beliefs associated with using technology: addressing professional and student needs. *Comput. Educ.* 55, 1321–1335. doi: 10.1016/j.compedu.2010.06.002

Palloff, R. M., and Pratt, K. (2009). Assessment, academic integrity, and community online. *Second* Edn. Hershey, Pennsylvania: IGI Global.

Pereira, O. R., and Rodrigues, J. J. (2013). Survey and analysis of current mobile learning applications and technologies. *ACM Comput. Surv.* 46, 1–35. doi: 10.1145/2543581.2543594

Petticrew, M., and Roberts, H. (2008). Systematic reviews in the social sciences: a practical guide. Hoboken, New Jersey: John Wiley & Sons.

Rafiq, F., Hussain, S., and Abbas, Q. (2020). Analyzing students' attitude towards e-learning: a case study in higher education in Pakistan. *Pak. Soc. Sci. Rev.* 4, 367–380. doi: 10.35484/pssr.2020(4-I)29

Regmi, K., and Jones, L. (2020). A systematic review of the factors-enablers and barriers-affecting e-learning in health sciences education. *BMC Med. Educ.* 20, 1–18. doi: 10.1186/s12909-020-02007-6

Ritchie, J., Lewis, J., Nicholls, C. M., and Ormston, R. (2003). Qualitative research practice. London: Sage.

Salas-Pilco, S. Z., Xiao, K., and Hu, X. (2022). Artificial intelligence and learning analytics in teacher education: a systematic review. *Educ. Sci.* 12, 1–18. doi: 10.3390/educsci12080569

Saleem, Q., Khan, M. A., Mahmud, S. A., Usman, M., Aslam, F., Saifullah, M., et al. (2023). Medical students expectations, experiences and use of E learning resources in higher education. *Pak. J. Med. Health Sci.* 17, 643–645. doi: 10.53350/pjmhs2023173643

Sangrà, A., Vlachopoulos, D., and Cabrera, N. (2012). Building an inclusive definition of e-learning: an approach to the conceptual framework. *Int. Rev. Res. Open Distance Learn.* 13, 145–159. doi: 10.19173/irrodl.v13i2.1161

Shahmoradi, L., Changizi, V., Mehraeen, E., Bashiri, A., Jannat, B., and Hosseini, M. (2018). The challenges of E-learning system: higher educational institutions perspective. *J. Educ. Health Promot.* 7, 116–121. doi: 10.4103/jehp.jehp_39_18

Shelton, C. C., Warren, A. E., and Archambault, L. M. (2016). Exploring the use of interactive digital storytelling video: promoting student engagement and learning in a university hybrid course. *TechTrends* 60, 465–474. doi: 10.1007/s11528-016-0082-z

Shisakha, M. B., Njuguna, F. W., and Ogeta, N. (2024). Institutional information communication technology capacity influence on E-learning utilization for instruction in Kenyan universities. *Msingi J.* 8, 27–45. doi: 10.33886/mj.v8i1.458

Shurygin, V., Saenko, N., Zekiy, A., Klochko, E., and Kulapov, M. (2021). Learning management systems in academic and corporate distance education. *Int. J. Emerg. Technol. Learn.* 16, 121–139. doi: 10.3991/ijet.v16i11.20701

Siemens, G. (2005). Connectivism: a learning theory for the digital age. *Int. J. Interact. Technol. Distance Educ.* 2, 3–10.

Simanjuntak, M., and Sukresna, I. M. (2023). The role of adaptive e-learning co-design as main solution to higher education's marketing performance. *Int. J. Learn. Teach. Educ. Res.* 22, 131–147. doi: 10.26803/ijlter.22.2.8

Sims, J., Vidgen, R., and Powell, P. (2008). E-learning and the digital divide: perpetuating cultural and socio-economic elitism in higher education. *Commun. Assoc. Inf. Syst.* 22, 1–16. doi: 10.17705/1CAIS.02223

Spring, K. J., and Graham, C. R. (2017). Blended learning citation patterns and publication networks across seven worldwide regions. *Australas. J. Educ. Technol.* 33, 1–13. doi: 10.14742/ajet.2632

Suppiah, S., Wah, L. K., Lajium, D. A., and Swanto, S. (2019). Exploring a collaborative and dialogue-based reflective approach in an e-learning environment via the community of inquiry (CoI) framework. *Comput. Assist. Lang. Learn. Electron. J.* 20, 117–139.

Torkzadeh, J., Ahangari, M., Mohammadi, M., Marzooghi, R., and Hashemi, S. (2022). Examining the external effectiveness components of e-learning to provide a framework for developing qualitative change in higher education. *Technol. Educ. J.* 16, 221–236.

Trelease, R. B. (2016). From chalkboard, slides, and paper to e-learning: how computing technologies have transformed anatomical sciences education. *Anat. Sci. Educ.* 9, 583–602. doi: 10.1002/ase.1620

Tugwell, O. O., and Maduabuchukwu, A. P. (2020). Impediments to effective utilization of e-learning platforms for quality teaching and learning in universities in Niger-Delta, Nigeria. *Int. J. Innov. Res. Dev.* 9, 18–22. doi: 10.24940/ijird/2020/v9/i7/JUL20021

Tuševljak, M., Majcen, L., Mervar, L., Stepankina, T., and Cater, B. (2016). E-learning in higher education: focus groups and survey among students in Central Europe. *J. Educ. Technol.* 13, 11–20. doi: 10.26634/jet.13.2.8160

Tyagi, S. K., and Krishankumar, R. (2023). Examining interactions of factors affecting e-learning adoption in higher education: insights from a fuzzy set qualitative and comparative analysis. *J. Sci. Technol. Policy Manag.* 1, 1–21. doi: 10.1108/JSTPM-02-2023-0022

Tymoshchuk, N. (2022). Implementing E-learning to support learning and teaching foreign language: a case study in Ukrainian higher education. *Arab World English J. 1*, 233–244. doi: 10.24093/awej/covid2.15

Van Dijk, J. A. (2006). Digital divide research, achievements, and shortcomings. *Poetics* 34, 221–235. doi: 10.1016/j.poetic.2006.05.004

Verma, R. K., Gupta, S., and Illinich, S. (2024). Technology-enhanced personalized learning in higher education. In *Advances in Technological Innovations in Higher Education*. (Eds.) A. Garg, B. V. Babau and Valentina E. Balas. Boca Raton: CRC Press, Taylor & Francis. 1, 71–92. doi: 10.1201/9781003376699-7

Violante, M. G., and Vezzetti, E. (2015). Virtual interactive e-learning application: an evaluation of the student satisfaction. *Comput. Appl. Eng. Educ. 23*, 72–91. doi: 10.1002/cae.21580

Wang, M., and Wang (2018). E-learning in the workplace. Berlin: Springer.

West, J., and Malatji, M. J. (2021). Technology integration in higher education: the use of website design pedagogy to promote quality teaching and learning. *Electron. J. E Learn.* 19, pp629–pp641. doi: 10.34190/ejel.19.6.2557

Wong, L. H., and Looi, C. K. (2011). What seams do we remove in mobile-assisted seamless learning? A critical review of the literature. *Comput. Educ.* 57, 2364–2381. doi: 10.1016/j.compedu.2011.06.007

Yurdugül, H., and Çetin, N. M. (2015). Investigation of the relationship between learning process and learning outcomes in e-learning environments. *Eurasian J. Educ. Res.* 15, 57–74. doi: 10.14689/ejer.2015.59.4