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A Systematic Literature Review on the Relationship Between Smart Learning Environments and Learning Performance in Higher Education

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Abstract

Smart learning environments, as an advanced educational technology, are widely acknowledged as a crucial component of contemporary educational systems. This study aims to examine the current literature concerning smart learning environments and their influence on learning performance in higher education. The writers examine papers published in ERIC over the past decade, focusing on their content, reasoning, terminology, methodology, and findings. This comprehensive literature review offers educators practical information on efficiently utilizing smart learning environments and provides academics with significant insights and references for further exploration in the topic. This will facilitate the advancement and refinement of smart learning environments in higher education to more effectively address contemporary educational demands and enhance student learning performance.

Keywords: smart learning environments, learning performance, higher education

1. Introduction

The ongoing development of Digital Learning Environments (DLEs) has sparked discussions regarding the necessity for educational reform and the improvement of learning environments. Consequently, an increasing cohort of academics has commenced active participation in this domain. In order to meet the requirements of learners, they collaborate to develop engaging

and effective learning environments (Huang et al., 2013; Scott & Benlamri, 2010; Zhu et al., 2016). In an effort to advance discipline, scholars have initiated the incorporation and utilization of innovative smart technologies, interactive elements, digital processes, and enhanced instruments (Byers et al., 2014; Huang et al., 2013; Spector, 2014). The aforementioned enhancements signify the initiation of the Smart Learning Environments (SLE) epoch.

Scholarly literature characterizes SLE as an advanced digital learning environment that is distinguished by its personalized approach, emphasis on interactive and adaptive learning features, learner-centric focus, and capacity to adapt to various contexts. Several studies (Huang, 2014; Kim et al., 2013; Sun et al., 2016; Zhu et al., 2016) provide support for this notion. However, alternative perspectives define SLE as a learning resource service that provides opportunities for self-directed learning, self-motivation, and customization, in addition to promoting collaborative learning and digital services (Kim et al., 2013; Koper, 2014). The wide array of definitions and explanations serves as a testament to the multifaceted nature and broad applicability of SLE within academic settings.

Smart learning environments encompass interactive learning activities that foster connection and engagement, while also diminishing obstacles between educators and learners, with the ultimate goal of facilitating the teaching and learning process (Carpenter, 2013; Metzger, 2015). Smart learning environments are educational settings that take into account technology and environmental elements with the goal of enhancing student learning outcomes (Byers et al., 2014; Painter, 2012). This study aims to comprehensively investigate, evaluate, and present the most recent research on smart learning environments and their impact on academic performance in higher education. The objective is to offer valuable references and insights to guide future research endeavors.

Smart learning environments are considered and interpreted as an overarching idea of joint learning aspects and social learning of type men, supporting digital content and interactive services (Vişan et al., 2021), so that they realize that each influences the person and the environment in order to respond to his or her individual needs in a variety of situations (Vișan et al., 2021).

Smart learning environments are regarded as an all-encompassing notion that integrates various facets of education, such as functionalities for adult social learning. Their primary aim is to enhance the learning process by integrating interactive services and digital content. This context recognizes the impact of various circumstances on each individual and environment, and consequently, it possesses the flexibility to adapt to specific requirements in order to meet the educational requirements of different situations (Cebrián et al., 2020).

Learning performances are measurable accomplishments and progress that students acquire during the course of their educational journey. This entails the development of expertise, capabilities, viewpoints, and fundamentals. Learning outcomes are a critical metric for assessing the effectiveness of instruction and serve as a foundational framework for evaluating students' progress. The evaluation of learning outcomes can be accomplished via an extensive array of methodologies, encompassing examinations, homework, projects, and

scholarly articles. Student, teacher, school, and other stakeholder collaboration is necessary to enhance learning outcomes. This entails fostering students' enthusiasm for acquiring knowledge, stimulating their motivation to learn, optimizing instructional approaches, and enhancing the overall quality of instruction and learning (Dinh, 2023).

1.1 Introduce the Problem

This study aims to provide a comprehensive and systematic analysis of existing data regarding the correlation between smart learning environments and learning performance. The importance of this research lies in the increasing reliance on technology and innovative educational practices in today's academic landscape (Bozkurt, 2020). As institutions strive to enhance student outcomes, understanding how intelligent learning environments contribute to academic achievement has become essential. The researchers seek to develop a thorough understanding of the current research landscape in relevant fields and explore critical topics in depth, which will help to clarify how these environments can be utilized effectively.

Initially, the focus will be on examining the particular objectives that academics typically establish in their investigations regarding smart learning environments and their influence on educational outcomes in higher education. This investigation will focus on examining the different objectives that have been pursued, including the enhancement of student engagement, the promotion of collaboration, and the improvement of personalized learning experiences. The study will also assess the methodologies utilized to meet these objectives, offering insights into the various approaches applied in the discipline. Through a thorough examination of both qualitative and quantitative methodologies, such as case studies, surveys, and experimental designs, this study aims to illuminate effective strategies for exploring intelligent learning environments.

Secondly the research will examine the elements of intelligent learning environments that have a substantial impact on student academic attainment and investigate the mechanisms underlying these impacts. This entails finding particular components that have been demonstrated to affect student performance, such as interactive tools, feedback systems, collaborative platforms, and adaptive learning technologies. In order to achieve successful academic outcomes, the researchers will examine how these elements interact with student traits, learning preferences, and institutional settings. The goal of this thorough analysis is to help academics understand the underlying mechanisms causing these effects so they may better understand how smart environments for learning might be designed to have the greatest possible impact.

Through a thorough analysis of these challenges, the researchers expect to provide substantial references for future research and practical support for educators. The findings from this research may inform the design and execution of intelligent learning environments, assisting educators in developing successful, engaging, and supportive learning experiences. The project aims to deepen comprehension of how intelligent learning environments might improve student performance, benefiting both instructors and learners in higher education. This holistic approach will enhance academic research and influence policy decisions and strategic activities designed to improve educational results.

1.2 Explore Importance of the Problem

The correlation between smart learning environments and learning performance necessitates more investigation owing to various crucial elements. Numerous research have examined the effects of technology-enhanced learning settings on student performance; nevertheless, the results are sometimes inconsistent or contingent upon context (Guerreiro, 2017). Certain studies indicate substantial enhancements in student results, however others propose negligible or adverse consequences (Mohamed Hashim et al., 2022). This contradiction necessitates a thorough investigation to resolve conflicting findings and ascertain the elements that influence these divergent outcomes (Criollo-C et al., 2021; Shin et al., 2020). Subsequent study can enhance theoretical frameworks by incorporating contemporary learning theories with the swift technological progress in educational settings (Al-Rahmi et al., 2021).

Additionally, from a practical standpoint, smart learning environments are gaining prominence in higher education, propelled by the necessity to customize instruction, enhance student engagement, and elevate overall educational achievements (Bezanilla et al., 2019; Peng et al., 2019)). Nonetheless, comprehension remains inadequate regarding the interaction of specific components within these environments—namely adaptive learning technologies, learning analytics, and virtual collaboration tools—with varied student demographics (Hassan et al., 2021). It is essential to address this gap, as educational institutions globally are investing substantially in technology to improve academic performance (Skare & Riberio Soriano, 2021). Comprehending the elements that lead to success in these contexts can guide improved policy decisions and educational initiatives, thereby addressing the practical issues encountered by educators and administrators (El-Sabagh, 2021).

Furthermore, the discourse regarding the efficacy of smart learning environments encompasses diverse viewpoints. Certain studies contend that these environments enhance student empowerment via autonomy and personalization, whilst others warn of the potential pitfalls of excessive dependence on technology, which could result in diminished face-to-face interaction and critical thinking (Kaimara et al., 2021; Vesin et al., 2018). This research aims to offer a comprehensive knowledge of the advantages and limitations of smart learning environments by offering a balanced perspective on these topics (Bezanilla et al., 2019).

This research aims to systematically review the literature regarding the influence of smart learning environments on academic achievement, with the objective of reconciling contradictory findings, enhancing existing theoretical frameworks, and offering practical recommendations for educational institutions. This review enhances the collective comprehension of the area by elucidating the mechanisms via which smart learning environments affect student achievement, hence informing future research and educational practices (Mohamed Hashim et al., 2022; Vesin et al., 2018).

2. Method

This systematic literature review was conducted in compliance with the 2020 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. PRISMA

provides a systematic approach for literature screening and extraction, ensuring the inclusion and evaluation of all relevant studies. The review methodology was organized around precise keyword selection, well defined inclusion and exclusion criteria, and comprehensive literature screening and selection. Following this, extensive data gathering and analysis were conducted, leading to a systematic evaluation of the domain.

This study employed systematic literature review methodology to investigate the correlation between smart learning environments and learning performance. A systematic literature review seeks to examine a certain topic by methodically locating, evaluating, collecting, and analyzing data from all relevant studies within a designated field.

A systematic review, which follows a stringent approach for data collection and organization, is more likely to produce accurate and valid results compared to a narrative literature review (Sawyer, 2017).

2.1 Identification

The researchers executed the search strategy manually, choosing to limit their search to the ERIC database. This database exclusively contains complete papers authored in English and published between January 2015 and January 2024. Researchers performed a thorough examination of the reference lists of all chosen papers to find pertinent research for the review. The search was performed using the terms "smart learning environment", "smart learning classroom", "learning environment", "learning Performance", "learning result", "learning outcome", "higher education". Articles containing at least one of these terms were selected. The terms that were chosen are: 'smart', 'learning environment', 'smart', and "teaching and learning environment". Some scholars use the terms "learning performance" and "learning achievement" interchangeably. Neglecting the notion of "learning performance" would have negative consequences for comprehensively grasping the matter and would fail to acknowledge significant contributions. Therefore, the keywords for this systematic review are summarized as follows: "smart learning environment" OR "smart learning classroom" OR "learning environment" AND "learning performance" OR "learning result" OR "learning outcome" AND "higher education"

2.2 Inclusion / Exclusion Criteria

The researchers devised certain criteria for selecting relevant studies that would address the study issues. The purpose of this study was to establish criteria for conducting systematic reviews in order to minimize any potential bias in the selection of studies (Trickey et al., 2012). The review included papers based on the following inclusion criteria (IC) and exclusion criteria (EC) (Table 1):

Table 1 Inclusion / exclusion criteria

Criteria	Inclusion	Exclusion
Article Type	All chosen research papers must undergo peer assessment and have their complete text accessible on ERIC.	Omit research if the material is either a book or a systematic review.
Time of Article Publication	This includes all research papers that were published throughout the time frame of 2015 to 2024, which spans a period of 10 years.	
Article Content Restrictions	Research full-text investigations, specifically those that have been published in ERIC.	
Article Research Subjects	Studies encompass publications in the field of higher education.	
Source		Research is not included if the paper is a review, letter, or chapter in a book.

2.3 Study Selection

According to the terms of research, ERIC acquired a grand total of 570 publications. Subsequently, 73 of them were chosen based on the criteria of title, abstract, and keywords. After reviewing the chosen articles (n=58), a total of 16 articles were identified that satisfied the specified criteria for inclusion and exclusion (as seen in Figure 1).

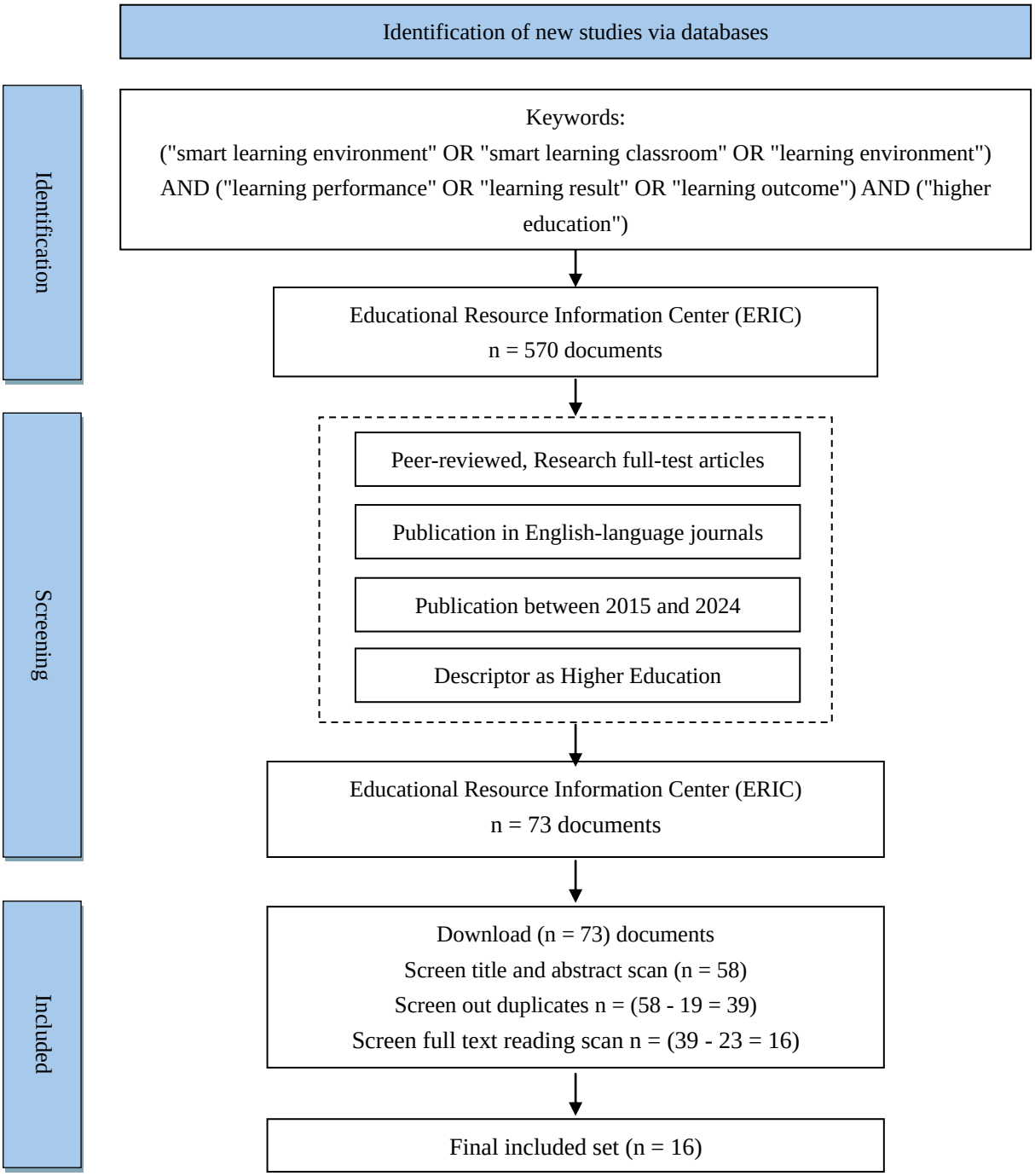

Figure 1. The PRISMA Flowchart describes the literature screening process for systematic search reviews

3. Results

This study employed content analysis as its primary research method, a systematic approach that enables researchers to analyze various forms of data effectively. Content analysis can be implemented using either quantitative or qualitative methods, which provides flexibility in

the analysis process. This versatility allows researchers to adapt their approach based on the specific characteristics of their data and the particular research questions they aim to address (Stemler, 2015).

In this study, the focus was placed on published studies, with a specific criterion of examining the publication year. This criterion was chosen to capture trends over time and to understand how the discourse around the research topic has evolved. By concentrating on the temporal aspect of the literature, the analysis aimed to reveal significant shifts or developments in the field related to intelligent learning environments and academic performance.

The narrative review aspect of the study played a crucial role in synthesizing the evidence gathered from the literature. It allowed for an organized presentation of findings, providing a comprehensive overview of the existing research landscape. Table 2, included in the study, showcases the key data extracted from the reviewed studies. This table serves as a visual summary, helping readers to grasp the essential insights quickly.

By structuring the content analysis in this manner, the study aims not only to offer a clear and organized overview of literature but also to highlight gaps and opportunities for future research. The combination of rigorous methodology and a focused research question ultimately contributes to a deeper understanding of how various factors influence academic success in smart learning environments. This approach lays the groundwork for subsequent investigations and supports the development of evidence-based educational practices.

3.1 Description of Included Studies

A total of sixteen investigations conducted in Indonesia (=1), Malaysia (=1), South Korea (=1), Turkey (=2), Vietnam (=1), the United States (=3), China (=2), Thailand (=1), Iran (=1), Canada (=1), Uganda (=1) and Saudi Arabia (=1) were considered. These studies were published between 2015 and 2024. The study with the smallest sample size consisted of 20 participants, while the study with the greatest sample size consisted of 5824 participants. Table 2 presents a concise overview of the study's year, location, methodology, and outcomes. All the studies included in the analysis employed various quantitative research designs.

Table 2. Characteristics of the reviewed studies

Author(s) and Year	Country	Journal	Authentic Assessment	Sample	Method	Relevant Finding
FITRA DELITA, NURMALA BERUTU, Dr. NOFRION (Delita et al., 2022)	Indonesia	Turkish Online Journal of Distance Education	Utilizing e-modules in online education can greatly enhance students' self-confidence, drive, and academic achievements, particularly when incorporating collaborative learning features.	90 students in 3 classes in the Department of Geography Education	Quasi-experimental	The use of e-modules in online learning significantly improves students' self-efficacy, motivation and learning outcomes. E-modules with collaborative learning are most effective.
HALIL YURDUGÜL, NIHAL MENZİ ÇETİN (Yurdugül & Çetin, 2015)	USA	Eurasian Journal of Educational Research	Learners' learning styles have a significant effect on their perception of learning, while deep strategies have a significant effect on academic performance. However, there is no significant relationship between perceived learning and actual learning performance.	68 undergraduate students in the Computer Networks and Communications program	Survey	Learners' approaches to learning greatly influence their perceived learning, and surface approaches also had a statistically significant effect. Deep strategies had a positive effect on academic performance, but deep motivation did not. Surface approach had a negative effect on academic performance, while there was no significant relationship between perceived and actual academic performance.

Table 1. (Continued.) Characteristics of the reviewed studies

Author(s) and Year	Country	Journal	Authentic Assessment	Sample	Method	Relevant Finding
KING-DOW SU (Su, 2021)	Taiwan, China	Journal of Baltic Science Education	Utilizing Socio-Scientific Issues Concept Maps (SSICM) as a Dynamic Learning Environment to Enhance Student Performance in Science	146 participants, including 139 students and 7 experts	Quasi-experimental, Interview	The design of SSICM scenarios, incorporating the rebuttal process, enhances students' argumentative skills and scientific learning. Concept mapping assessment tools improve students' learning attitudes and scientific performance, while also boosting their lower-order cognitive skills. Teachers play a crucial role in argumentative learning, helping to elevate students' scientific knowledge. Additionally, the SSI concept mapping dynamic learning environment enhances students' scientific performance and learning attitudes, while also improving teaching effectiveness.
TAMI IM and MINSEOK KANG (Im & Kang, 2019)	Korea	International Review of Research in Open and Distributed Learning	The relationship between learners' achievement goal orientation, self-regulation, test anxiety, self-efficacy, engagement, satisfaction and achievement in a Korean online learning environment.	1,832 students in cyber universities	Survey	This study finds that test anxiety positively correlates with engagement, satisfaction, and achievement, which differs from mainstream research that typically reports a negative correlation. While most studies on text anxiety indicate a negative link to achievement, some, like those by Sung et al. (2016) and Hardy & Hutchinson (2007), suggest a positive correlation. These researchers argue that test anxiety can enhance performance motivation and improve scores based on the motivation-enhancing model.

Table 2. (Continued.) Characteristics of the reviewed studies

Author(s) and Year	Country	Journal	Authentic Assessment	Sample	Method	Relevant Finding
JODI POTTER (Potter, 2015)	USA	Journal of Instructional Pedagogies	Hybrid instruction improves student learning and learning outcomes.	100 undergraduate business college students	Quasi-experimental	Blended instruction enhances student performance, with hybrid course formats significantly outperforming traditional face-to-face formats. Teachers must prepare course materials in advance and proactively address students' technical issues.
JEYA AMANTHA KUMAR, BALAKRISHNAN MUNIANDY, WAN AHMAD JAAFAR,WAN YAHAYA (Kumar et al., 2016)	Malaysian	Malaysian Online Journal of Educational Technology	The study examines the impact of gender and academic achievement, as measured by cumulative grade point average (CGPA), on the learning outcomes of post-secondary students in a multimedia learning environment.	33 students from the Diploma of Electronic Engineering course	Quasi-experimental	There is no significant difference in CGPA by gender. Males are more positive and satisfied with negative emotion design than females. High achievers prefer Positive Design (PosD), with females showing a stronger preference. Emotional design impacts users' emotions and cognition, affecting learning outcomes.
SHIXIN FANG, YI LU, GUIJUN ZHANG (Fang et al., 2023)	China	Online Learning Journal	External factors such as technology, atmosphere, and instruction will cause unfavorable psychological characteristics to become internalized, which will then indirectly forecast student happiness with online learning.	5824 Chinese undergraduate students	Survey	The study found that teachers' online experience and communication significantly enhance student satisfaction, while technology and environment are viewed negatively. Chinese students prioritize the practicality of online learning and material quality more than Western students, emphasizing the importance of teacher-student interaction. Additionally, attitudes and emotions mediate the relationship between network quality, learning environment, and satisfaction. The research recommends prioritizing faculty training and improving technology and support for effective online learning.

Table 3. (Continued.) Characteristics of the reviewed studies

Author(s) and Year	Country	Journal	Authentic Assessment	Sample	Method	Relevant Finding
SOMAYEH FATAHI, SHAKIBA MORADIAN (Fatahi & Moradian, 2018)	Iran	International Conference e-Learning	Adaptive e-learning environments possess the ability to comprehend their emotional condition, react to it in a suitable manner, and enhance the rate of learning.	20 students in electrical and computer engineering	Quasi-experimental	Students in the experimental group showed higher levels of engagement and congruence with their personality traits in adaptive e-learning environments. These environments also allowed for a better understanding of their emotional state, appropriate responses, and improved their learning efficiency and performance.
WENDY BARBER, SHERRY KING (Barber & King, 2016)	Canada	The Electronic Journal of e-Learning	Teachers are required to adapt their teaching methods in response to digital learning environments, in order to enhance students' learning experience and performance.	60 students and 2 teachers	Quasi-experimental, Semi-structured Interview	Teachers must master online teaching skills to adapt to changing education environment. Problem-Based Learning (PBL) emphasizes the role of teachers as facilitators who support students and create contexts for learning. PBL fosters self-responsibility and social capital while developing critical thinking and collaboration skills. However, it poses challenges for teacher skills and assessment. Overall, PBL enhances student engagement, motivation, and the quality of outcomes, improving conditions for effective problem-based learning.
MEHMET KOKOC (2019)	Turkey	Themes in eLearning	Perceived Time Flexibility and Perceived Content Flexibility have a notable and beneficial impact on behavioral engagement and academic achievement in digital learning environments.	119 higher education students	Quasi-experimental	Perceived time and content flexibility significantly enhance behavioral engagement and learning performance, while perceived teacher contact flexibility has no significant effect. These findings help clarify the role of flexibility in online learning and provide insights for e-learning design.

Table 4. (Continued.) Characteristics of the reviewed studies

Author(s) and Year	Country	Journal	Authentic Assessment	Sample	Method	Relevant Finding
BEOMKYU CHOI (Choi, 2023)	USA	International Journal of Technology in Education	The manner in which students participate in asynchronous online learning environments impacts their learning experience, which is closely connected to their academic success.	26 students	Survey	Students in different participation modes show significant differences in learning satisfaction during asynchronous online discussions, with efficient and synthesizing students scoring higher, while disengaged students score lower. Additionally, participation modes are associated with student learning outcomes. This study expands the learning literature and highlights the important role of participation modes in students' learning experiences.
SEHAM SALMAN ALJRAIWI (Aljraiwi, 2017)	Saudi Arabia	Journal of Education and Learning	Female students exhibit greater enthusiasm for studying and achieve superior academic performance both in traditional classroom settings and in online learning environments, both during and after class. Teachers utilize online learning platforms to enhance students' engagement in the learning process and enhance their motivation and academic success.	40 female students of the College of Education	Quasi-experimental	This study introduces a web applications-based learning environment aimed at enhancing classroom teaching and learning activities. It enables teachers to better facilitate student contributions, thereby increasing motivation and performance. The case study revealed that female students showed greater interest and achieved better results when using these applications during and after class, benefiting from suitable educational support. Furthermore, the applications offer effective assistance to both teachers and students in managing and guiding educational activities both inside and outside the classroom.

Table 2. (Continued.) Characteristics of the reviewed studies

Author(s) and Year	Country	Journal	Authentic Assessment	Sample	Method	Relevant Finding
BASHIR KISHABALE (Kishabale, 2021)	Uganda	International Journal of Education and Development using Information and Communication Technology	The quality of an e-learning environment's interface design (including content interactivity, Accessibility design, system navigation, and visual aesthetic design, using validating factors) is a significant predictor of learner satisfaction; in turn, satisfaction affects learning agility.	232 E-learners in selected Ugandan higher learning institutions	Survey	Interface design quality significantly predicts learners' satisfaction and learning agility. Key aspects, such as content interactivity, accessibility design, system navigation, and visual aesthetics, have a notable impact on learners' satisfaction. System navigation directly influences satisfaction in E-learning environments, while learner satisfaction mediates the relationship between system navigation and learning agility. The multi-dimensional structure of interface design quality—comprising content interactivity, accessibility design, system navigation, and visual aesthetics—has a significant effect on both satisfaction and learning agility, providing valuable insights for instructional design and evaluation.
CAO TUONG DINH (Dinh, 2023)	Vietnam	Turkish Online Journal of Distance Education-TOJDE	The Impact of a Coordinated Online Learning Environment on Student Cognitive Engagement, Satisfaction, and Academic Performance	186 participants	Survey	Synchronous online learning environments positively impact students' cognitive engagement, deep participation, and academic achievement. Technical support directly boosts academic performance and satisfaction. Analysis of Korean university students indicates that higher engagement leads to greater satisfaction, with strong links among teaching guidance, social interaction, technical support, cognitive participation, satisfaction, and academic success. However, the effect of technical support on cognitive participation is still unclear.

4. Discussion

Although governments are increasingly acknowledging the significance of smart learning environments—often referred to as e-learning environments or networked e-environments, improving students' learning performance continues to be a complex challenge. Despite advancements in technology and educational strategies, educators and policymakers face obstacles in effectively leveraging these environments to boost academic outcomes.

A thorough examination of the available studies has revealed a variety of factors that influence learning performance in these settings. These factors can be organized into distinct domains, each highlighting different aspects of the learning experience. Understanding these domains is crucial for developing targeted interventions and strategies that can enhance student engagement and achievement in smart learning environments.

The identified domains may include elements such as technological infrastructure, pedagogical approaches, student motivation, collaborative opportunities, and feedback mechanisms, among others. By focusing on these areas, stakeholders can work towards creating more effective and supportive learning environments that truly enhance educational performance.

4.1 Factors that Smart Learning Environments (SLEs)

The integration of social media as an educational tool (Dinh, 2023) has emerged as a transformative approach in modern education, facilitating greater interaction and collaboration among students. This innovative use of technology not only fosters communication but also encourages peer-to-peer learning, enhancing the overall learning experience. Coupled with the creation of flexible learning environments (Fatahi & Moradian, 2018), which allow for personalized and adaptable learning experiences, these strategies collectively contribute to a more dynamic and responsive educational setting.

Additionally, the style of participation in online conversations (Choi, 2023) plays a crucial role in shaping the learning experience. Different modes of engagement can influence how students interact with content and with each other, impacting their overall satisfaction and cognitive involvement. Furthermore, the quality of interface design (Kishabale, 2021) cannot be overlooked, as it affects how easily learners can navigate and engage with online materials. A well-designed interface enhances usability and encourages more active participation, leading to improved learning outcomes.

Moreover, the configuration of synchronized online learning environments (Dinh, 2023) introduces a layer of interactivity that can significantly boost learners' engagement levels. These environments facilitate real-time interaction, making learning more immersive and collaborative. Together, these factors—social media utilization, flexible learning environments, participation styles, interface quality, and synchronized setups—interact in complex ways to enhance learners' satisfaction, performance, and cognitive engagement, ultimately leading to a richer educational experience. Understanding and optimizing these elements is essential for educators and institutions striving to improve learning outcomes in today's digital age.

4.2 Factors that Learning Performance (LP)

The correlation between interface design quality, technical support, and learning outcomes in online learning environments has been thoroughly examined, as highlighted in the study by Bashir Kishabale (2021). Additionally, Kitchakarn (2021) explored how online learning resources, including social media, influence academic achievement, showing that these tools can significantly enhance students' educational experiences.

In a more recent study, Dinh (2023) found that instructional support and interaction are critical factors affecting learning performance. This performance is further influenced by variables such as enjoyment of the learning process and motivation levels. For more insights on this topic, refer to Kartal's study from 2022, which offers relevant findings.

Moreover, Fatahi and Moradian (2018) investigated how customized learning experiences, tailored to individual personalities and emotions, impact academic performance. Their research underscores the importance of personalization in enhancing learning outcomes. Aljraiwi (2017) also noted that the learning environment and social support play significant roles in determining learning performance, reinforcing the notion that a supportive and engaging atmosphere is essential for academic success. Collectively, these studies contribute to a deeper understanding of the various factors that influence learning in online settings.

4.3 Smart Learning Environments Influence Learning Performance

The quality of technical assistance and interface design is fundamental to shaping the student learning experience, as both elements significantly influence student engagement and effectiveness in educational settings (Kishabale, 2021). When technical support is efficient and the user interface is well-designed, students are likely to experience greater enjoyment and motivation during their learning activities. This heightened sense of enjoyment can lead to a more immersive and productive learning experience, ultimately enhancing academic performance.

To further optimize student learning efficiency and achieve desired educational outcomes, it is crucial to utilize appropriate online learning tools and software effectively. For example, integrating tools such as social media and online discussion forums can greatly enhance students' ability to acquire information and participate in collaborative exchanges of ideas. These platforms encourage interaction and engagement, allowing students to benefit from diverse perspectives and collective knowledge (Kitchakarn, 2016). Such interactions can deepen understanding and promote critical thinking skills.

In addition to technical factors, the quality of education provided and the active involvement of students are essential components of the teaching and learning process (Dinh, 2023). Educators who foster an engaging and stimulating learning environment can ignite students' curiosity and drive for knowledge. This engagement not only boosts motivation but also reinforces a commitment to academic success, leading to improved performance across various subjects.

Creating a supportive learning environment is equally important for student success.

Establishing strong social support systems allows students to focus on their studies and enhances their academic achievements (Kartal, 2022). Supportive relationships with peers and educators can facilitate integration into the learning process, making it easier for students to navigate challenges and remain motivated.

Moreover, the relationship between students' satisfaction with their learning environment and their motivation is closely linked to their academic progress (Fatahi & Moradian, 2018). Students who feel a sense of satisfaction and fulfillment in their learning experiences are generally more motivated to engage with the material and invest effort in their studies. This motivation, in turn, translates into better academic results, creating a positive feedback loop of achievement and satisfaction.

Personalized learning experiences also play a critical role in enhancing student performance. Tailoring educational experiences to meet the unique needs of individual students—considering their personalities, learning styles, and emotional responses—can significantly improve the effectiveness of instruction. By addressing these individual learning requirements, educators can create a more inclusive and effective educational environment that leads to enhanced academic outcomes (Aljraiwi, 2017).

In conclusion, the interplay of high-quality technical assistance, effective interface design, and a supportive learning environment are essential for fostering student engagement and academic success. By incorporating personalized learning experiences and leveraging appropriate online tools, educators can create dynamic and enriching educational experiences that meet the diverse needs of their students, ultimately paving the way for improved academic performance and satisfaction.

4.4 Longitudinal Insights into Smart Learning Environments and Learning Performance

Many studies use cross-sectional designs, which limits their potential to capture long-term effects, even if prior talks have emphasized the immediate consequences of smart learning environments on learning performance. For example, research like Dinh (2023) and Kishabale (2021) found a high relationship between learning agility, user pleasure, and interface design quality. The stability and longevity of these effects over time, however, have not been investigated because these findings are limited to short-term observations.

A distinctive viewpoint for determining how interventions change and maintain their effectiveness is provided by longitudinal studies. For instance, Dinh (2023) observed that academic performance is positively impacted by technical help; however, it is unclear if this benefit would endure as students adjust to new technology. Similar to this, Fatahi and Moradian (2018) showed that by adjusting to students' emotional states, adaptive learning environments greatly increase engagement. However, long-term studies are required to confirm if these emotional ties maintain better performance.

Additionally, flexible learning designs (Kokoc, 2019) and participation modalities in synchronous and asynchronous learning settings (Choi, 2023) show potential in improving learning results. To ascertain these dynamics' long-term effectiveness and capacity to promote enduring learning habits, however, temporal study is necessary.

Future studies that use longitudinal approaches will be better able to understand the temporal dynamics of smart learning environments and offer solid proof of their causal links to learning outcomes. Researchers can assist educators in creating interventions that are not just short-term successful but also long-lasting and flexible enough to accommodate students' changing requirements by broadening the temporal scope.

5. Systematic Review Limitations

The principal benefit of a systematic review, as opposed to a conventional narrative review, is its capacity to systematically and consistently identify all available information in a reliable and reproducible fashion. This systematic method facilitates a thorough evaluation of the existing literature, guaranteeing that significant studies are not disregarded. Consequently, our study selected a systematic review methodology instead of a narrative literature review.

Even though this study provides a systematic review of the relationship between smart learning environments and learning performance, there are some limitations.

Firstly, the sample representativeness is limited. Many studies have small sample sizes and are geographically limited, such as focusing only on pre-service teachers in Turkey or tertiary students in Vietnam (Dinh, 2023; Fang et al., 2023). These limitations may affect the generalizability of the findings. Future studies should expand the geographic and demographic diversity of the samples to improve external validity.

Secondly, there were limited research factors. Some studies only explored the effects of specific variables (e.g., gender and years of undergraduate study) on perceptions of teaching without considering other potential influences (e.g., motivation, learning strategies, etc.) (Aljraiwi, 2017; Barber & King, 2016; Fatahi & Moradian, 2018). In order to fully understand the complex relationship between perceptions of teaching and academic achievement, it is recommended that more relevant variables be included in the study design.

Thirdly, the study design presents limitations. The majority studies employed a cross-sectional design, which obscures causal clarity. To more effectively investigate causal relationships among variables, future research should adopt a longitudinal study design to capture dynamic changes.

Fourth, there are context-specific limitations. Research has predominantly concentrated on particular learning environments (e.g., synchronous online learning) and has insufficiently addressed the influence of asynchronous online learning environments or other types of learning contexts. Consequently, it is advisable for future research to synthesize the multifaceted effects of various learning environments on learners' cognitive engagement, satisfaction, and academic performance.

Fifth, constraints in data acquisition methodologies. Several research predominantly utilized self-reported data, potentially affected by participants' subjective biases. Consequently, integrating several data gathering methodologies (e.g., quantitative and qualitative research) will enhance the study's credibility and the trustworthiness of the findings.

The correlation between technology adoption and user pleasure. Current research indicates a

strong correlation between learners' satisfaction with interface design quality and learning results; nevertheless, there is limited investigation into specific applications and enhancements (Kishabale, 2021). Future study should focus on optimizing technology applications to more effectively address learners' requirements and improve learning results.

The researchers employed a specialized database pertinent to the study's topic in this review. Although this database may not include all pertinent studies in the field, the researchers are assured that their stringent methodology has significantly minimized the likelihood of overlooking any essential material that could influence the publication's conclusions.

Based on the findings of this systematic review, it is recommended to do additional research or surveys to examine students' perceptions of intelligent educational settings and their impact on academic performance. Comprehending these viewpoints can offer significant context and guide the formulation of more effective instructional methodologies.

6. Implications for Future Research

Further research should be conducted using prospective experimental methods to rigorously evaluate treatments that can effectively enhance the academic performance of university students in smart learning environments. By employing experimental designs, researchers can systematically assess the impact of specific interventions, thereby providing robust evidence regarding their effectiveness. This approach will not only validate the interventions but also contribute to the broader understanding of how various factors within smart learning environments influence student outcomes.

Policymakers and stakeholders have a critical role in this research landscape. It is imperative that they allocate sufficient resources to support studies in this domain. Such investments are essential for ensuring that technology and smart learning environments evolve in tandem with the growing educational needs of students and institutions. As educational paradigms shift and technology become increasingly integrated into teaching and learning processes, the importance of evidence-based strategies cannot be overstated. Ensuring that our educational frameworks are responsive to these changes will help prepare students for the challenges of the future.

While a variety of subjects related to smart learning environments are currently being examined—ranging from English education to nursing professional training—most research has predominantly focused on isolated programs. This limited focus restricts our understanding of the broader implications of smart learning environments across multiple academic disciplines. To gain a comprehensive insight into their effectiveness, it is crucial to broaden the research scope.

Furthermore, the majority of recent research uses cross-sectional designs, which, although they show direct links between smart learning environments and learning ability, do not account for the long-term impacts or dynamic changes of these associations. For example, research like Dinh (2023) have shown the short-term advantages of technical support on learning performance, but it is yet unknown how long-term effects would last. Longitudinal designs should be given priority in future studies in order to track students' development over

time and provide a better understanding of causal links.

Conducting studies on smart learning environments across various fields will enable researchers to assess their impact on student learning outcomes and performance more holistically. For instance, exploring how smart learning environments function in the context of STEM education, the arts, or social sciences can provide valuable insights into best practices and potential challenges. This expanded research agenda will not only enhance our knowledge of smart learning environments but also inform educators and administrators on how to optimize these technologies for diverse learning needs. Ultimately, such comprehensive research efforts will contribute to the development of more effective educational strategies that cater to all students, fostering a culture of academic excellence and continuous improvement.

7. Conclusions and Recommendations

The relationship between smart learning environments and academic success is critical for student development. When students can clearly identify their strengths and potential, they are better equipped to acquire the necessary skills to make informed decisions about their educational pathways. Research indicates that several key components of smart learning environments significantly enhance student achievement (Kishabale, 2021). These components include personalized learning paths, real-time feedback systems, interactive learning tools, and data-driven educational decision-making(Aljraiwi, 2017; Choi, 2023; Kokoc, 2019). The integration of these elements fosters a more efficient and focused learning environment, which in turn leads to improved learning outcomes and performance.

These findings not only highlight the positive impact of smart learning environments on student performance but also provide important strategic guidance for the education sector (Barber & King, 2016; Fang et al., 2023; Fatahi & Moradian, 2018). Educational institutions can leverage these insights to develop more empirical and rational strategies, thereby advancing the overall education system. By implementing and refining the essential components of smart learning environments, educators can better meet students' learning needs, improve educational quality, and cultivate individuals with innovative skills and well-rounded characteristics. The connection between smart learning environments and academic performance is vital for individual growth and plays a significant role in the reform and advancement of the entire education system (Im & Kang, 2019; Potter, 2015; Su, 2021).

Based on the study's findings, researchers propose several recommendations to enhance student performance in smart learning contexts. First, there is a need to deepen the exploration of smart learning environments across various sectors. This can be achieved by aligning advancements in the professional field with technological improvements to enhance skills and optimize job performance. Additionally, integrating soft skills and experiential learning into the school curriculum is essential. This can be done through seminars, internships, peer reviews, and fostering interactions between teachers and students, as well as among students themselves.

Furthermore, educators should emphasize the importance of technology, student engagement,

multimedia resources, and supplementary activities in the curriculum. By prioritizing these elements, they can create a more engaging and effective learning experience. Simultaneously, students should take the initiative to adapt to diverse digital learning environments, which will not only enhance their academic achievements but also improve their competitiveness in the job market. This proactive approach will prepare them for future challenges and opportunities, ultimately contributing to their overall success and development.

In order to determine the long-term impacts of smart learning environments and their causal linkages with learning performance, future research should give priority to longitudinal study approaches. For instance, researchers can obtain a more thorough grasp of the sustainability of technological interventions by monitoring learners' behavioral changes over time while utilizing various smart learning tools. In addition to addressing the drawbacks of cross-sectional designs, these kinds of studies would strengthen the theoretical underpinnings of educational technology design.

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