Impact of e-learning service quality on student satisfaction during the Covid-19 pandemic: A systematic review

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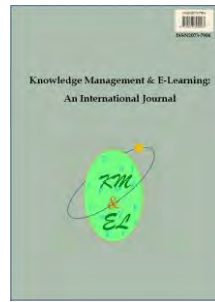## Yam B. Limbu*

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Abstract: Educational institutions around the world transitioned from face-to-face learning to online learning as a direct result of the COVID-19 pandemic. This sudden transition had grave consequences on e-learning service quality (ELSQ) and student satisfaction with online learning; however, what dimensions of ELSQ impacted student satisfaction most during the COVID-19 pandemic remain unclear. This study represents the first systematic effort reviewing and synthesizing the available literature on the relationships between the various dimensions of ELSQ and student satisfaction with online learning during the COVID-19 pandemic. We searched the databases Education Source, Education Resources Information Center, and Computer & Applied Sciences Complete for quantitative studies. The results show that ELSQ dimensions were positively associated with student satisfaction with e-learning during COVID-19 pandemic. System quality was the most commonly demonstrated predictor of student satisfaction, followed closely by instructor and course material quality. Little research has focused on the administrative and support service aspect of ELSQ. The most frequent system-related subdimensions were perceived ease of use, perceived usefulness, website design and content, responsiveness, functionality, technical support, advantages and compatibility of ICT, and information quality. The most prevalent instructor- and course-related subdimensions were the course content and design, instructor quality, student-student and student-instructor interactions, responsiveness, and instructor support.

Keywords: e-Learning service quality; System quality; Instructor and course material quality; Administrative and support service quality; Student satisfaction; COVID-19; Systematic review

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1. Introduction

The COVID-19 pandemic severely impacted several industries, and the education sector was no exception. The pandemic forced colleges and schools around the world to transition from face-to-face learning to e-learning, also called online, distance, or virtual learning, which uses electronic technology and media to deliver, support, and enhance both learning and teaching and involves communication between learners and teachers and the use of online content (Howlett et al., 2009). According to the 2020 U.S. Census, 93% of people in households with school-aged children reported that their children engaged in some form of e-learning during the COVID-19 pandemic (U.S. Census, 2020). This sudden transition presented unprecedented challenges for students, educators, and administrators. Higher educational institutions faced immense challenges of improving students' performance and determining the factors that impacted students' satisfaction with online learning during COVID-19 pandemic (Agyeiwaah et al., 2022). An area of concern among educators that has attracted considerable scholarly attention is the service quality of online learning and its impact on student satisfaction during the COVID-19 pandemic.

In the e-learning context, student satisfaction refers to the students' overall satisfaction with online instruction and with the support of the teachers and the student counseling service (Kerzic et al., 2021). One of the critical factors that affects student satisfaction with online learning is e-learning service quality (Pham et al., 2019), which is a complicated multi-faceted construct that can be defined from the perspectives of learners, instructors, assessors, and governments. In this study, we define e-learning service quality (ELSQ) from the learners' perspectives as the difference between the students' service expectations and their experiences of online learning. In other words, e-learning service quality refers to the quality of e-learning provided by higher education institutions such as system quality, instructor quality, course content quality, and administrative service quality (Pham et al., 2019).

Numerous studies have examined the effects of a wide range of ELSQ dimensions on student satisfaction (e.g., Kumar et al., 2021; Puriwat & Tripopsakul, 2021; Saad et al., 2021; Saxena et al., 2021). Despite the growing literature on this topic, no systematic review has been carried out to summarize and synthesize the studies that have examined the links between the ELSQ dimensions and student satisfaction. Specifically, it is still unclear what dimensions of ELSQ were the most prevalent and dominant predictors of student satisfaction with e-learning during the COVID-19 pandemic. Moreover, little is known about the subdimensions of ELSQ that were positively associated with student satisfaction. This study aims to fill the gap by systematically reviewing the empirical studies that examined the impact of e-learning service quality on students' satisfaction.

This study provides valuable and holistic insights on the determinants of student satisfaction with e-learning during the COVID-19 pandemic. Understanding the antecedent factors impacting students' satisfaction with e-learning outcomes can help instructors, administrators, instructional designers, and all those involved in developing and implementing virtual learning to take the necessary actions to enhance the quality of students' performance, especially during the exceptional times, such as the COVID-19 pandemic (Nikou & Maslov, 2023). Remote learning has become part of the new normal during the COVID-19 pandemic and some form of distance or blended learning will likely continue even in the post-pandemic era (Oladele et al., 2022). The results of the present study will offer a clear strategy for education, research, and policy in creating a plan for effective distance learning in highly unusual circumstances such as the COVID-19 pandemic.

2. e-Learning service quality

Today's higher education institutions are pursuing a student-centered strategy. The essence of this strategy is to see students as customers, and universities must do their best to provide the highest quality educational services to students (Pham et al., 2022). With the emergence of modern information and communication technology, online learning has become an increasingly popular mode of instruction in higher education. The quality of e-learning has thus received considerable attention both from educational institutions and learners, and a question arises: What factors contribute to e-learning service quality? Answering this question is the key to improving the overall quality of e-learning services, which is the foundation for student satisfaction with e-learning.

Prior research has conceptualized e-learning service quality as a multidimensional and wide-ranging construct. For example, Shaik et al. (2006) suggested that teaching quality, administration, and support services play an important role in creating e-learning service quality. Peltier et al. (2007) indicated that factors such as student-student interactions, faculty-student interactions, lecture delivery, course content, course structure, and instructor support can be used to measure e-learning service quality. Wang et al. (2007) pointed out that system quality, information quality, and service quality determine an e-learning system's success.

In a study on e-learning acceptance, Lee (2010) found that the quality of online support services was highly correlated with e-learning acceptance and student satisfaction. Martínez Argüelles et al. (2013) developed a scale consisting of four factors to assess e-learning service quality. These four factors include: teaching quality, administrative and motivating services, support services, and user interfaces. Furthermore, Martínez-Argüelles and Batalla-Busquets (2016) emphasized that e-learning service quality includes the teaching service quality and non-teaching service quality. Teaching services act as the core services, while non-teaching services consist of administrative services, additional services, and user interfaces.

Ozkan and Koseler (2009) focused on support issues, faculty attitudes, content quality, service quality, and system quality, which play important roles in influencing e-learning service quality. Goh et al. (2017) emphasized that course design, interactions with instructors, and interactions among students are factors that influence the success of an online learning system. Pham et al. (2019) developed a comprehensive and integrated framework for assessing the quality of e-learning services. Based on various studies of traditional business services, online business services, traditional learning, and online learning, the authors developed a scale consisting of e-learning system quality, e-learning

instructor and course materials quality, and e-learning administrative and support service quality. They also examined the impact of these factors on student satisfaction. In summary, pre-COVID-19 studies in the field of e-learning provide various attributes that measure e-learning service quality. Each attribute or group of attributes is constructed from different perspectives and research contexts.

Numerous studies have examined e-learning service quality and its impact on student satisfaction with online learning during the COVID-19 pandemic, but little is known about what the most prevalent dimensions of e-learning service quality are, or about their impact on student satisfaction. The current study addresses this issue. This paper reviews and synthesizes the extant literature to gain insights into the overall impact of ELSQ on student satisfaction during the COVID-19 pandemic. We use the theoretical foundation of Pham et al. (2019) in which e-learning service quality consists of three elements: (1) system quality, which represents the technology aspect of the e-learning system, especially the design, content, friendliness, flawlessness, efficiency, and adaptability of the e-learning system, e-learning website, hardware, and software; (2) instructor and course material quality, which includes attributes such as instructor quality, interactions between instructors and students, instructor support and mentoring, course content and; (3) administrative and support service quality such as the help-desk service, academic and career advising, administrative staff support, enrolment, registration, and financial support.

3. Research questions

The following research questions are addressed in this review:

RQ1: What e-learning service quality dimensions positively impacted student satisfaction with online learning during the COVID-19 pandemic?

RQ2: Which dimension of e-learning service quality was the most commonly demonstrated predictor of student satisfaction with online learning during the COVID-19 pandemic?

RQ3: What were the most prevalent subdimensions of e-learning service quality that positively impacted student satisfaction with online learning during the COVID-19 pandemic?

4. Methods

4.1. Search strategy

A systematic search of three databases (i.e., Education Source, Education Resources Information Center, Computer & Applied Sciences Complete) was performed to obtain studies using a set of search keywords. The following terms were used in combination to search all databases: e-learning, online learning, virtual learning, or distance learning; service quality; system quality; instructor and course materials quality; administrative and support service quality; student satisfaction; coronavirus or COVID-19 or SARS-CoV-2; and college, university, or higher education. To locate relevant studies, we used several Boolean operators (see Table 1).

Table 1
Key terms or Boolean operators used for search

Search	Search Terms (Boolean operators)
1	"e-learning" OR "online learning" OR "virtual learning" OR "distance learning" AND "service quality" AND "satisfaction" AND "COVID-19" AND "College" OR "University" OR "Higher Education"
2	"e-learning" OR "online learning" OR "virtual learning" OR "distance learning" AND "service quality" AND "satisfaction" AND "coronavirus" AND "College" OR "University" OR "Higher Education"
3	"e-learning" OR "online learning" OR "virtual learning" OR "distance learning" AND "service quality" AND "satisfaction" AND "SARS-CoV-2" AND "College" OR "University" OR "Higher Education"
4	"e-learning" OR "online learning" OR "virtual learning" OR "distance learning" AND "system quality" AND "satisfaction" AND "COVID-19" OR "coronavirus" OR "SARS-CoV-2" AND "College" OR "University" OR "Higher Education"
5	"e-learning" OR "online learning" OR "virtual learning" OR "distance learning" AND "instructor quality" AND "satisfaction" AND "COVID-19" OR "coronavirus" OR "SARS-CoV-2" AND "College" OR "University" OR "Higher Education"
6	"e-learning" OR "online learning" OR "virtual learning" OR "distance learning" AND "course materials quality" AND "satisfaction" AND "COVID-19" OR "coronavirus" OR "SARS-CoV-2" AND "College" OR "University" OR "Higher Education"
7	"e-learning" OR "online learning" OR "virtual learning" OR "distance learning" AND "administrative support quality" AND "satisfaction" AND "COVID-19" OR "coronavirus" OR "SARS-CoV-2" AND "College" OR "University" OR "Higher Education"
8	"e-learning" OR "online learning" OR "virtual learning" OR "distance learning" AND "student service quality" AND "satisfaction" AND "COVID-19" OR "coronavirus" OR "SARS-CoV-2" AND "College" OR "University" OR "Higher Education"

4.2. Criteria for inclusion and exclusion

We systematically searched for articles published in peer-reviewed journals from January 2020 to May 2022. Of the articles found in the search, analysis included only quantitative empirical studies published in English. We excluded qualitative studies, non-peer reviewed studies, conference proceedings, case reports, and other grey literature. All abstracts and full texts were screened independently by two trained coders. The coders independently reviewed the articles and extracted and coded the data including the author's name, publication title, publication year, country investigated, study design, sample size, statistical analysis employed, relationship investigated, and key findings.

This review was performed in accordance with the PRISMA guidelines. As shown in Fig. 1, the search strategy identified a total of 722 articles. After removing duplicates, qualitative studies, non-peer-reviewed studies, and conference proceedings, 235 articles were further screened. Of these, 184 studies were excluded after screening the abstracts, as they were not relevant studies; they did not examine the association between the ELSQ dimensions and student satisfaction; and full texts were not available. The remaining 51 articles were further assessed for eligibility. Of these, 12 articles were removed as they did not report the necessary statistics or perform an appropriate statistical analysis. The remaining 39 studies were found eligible for this review.

4.3. Analytical process

Data were analysed using IBM SPSS Statistics 27. First, we present the descriptive statistics for the ELSQ dimensions that were positively associated with student satisfaction. Second, we present the frequencies for the ELSQ subdimensions that were positively and significantly related to student satisfaction.
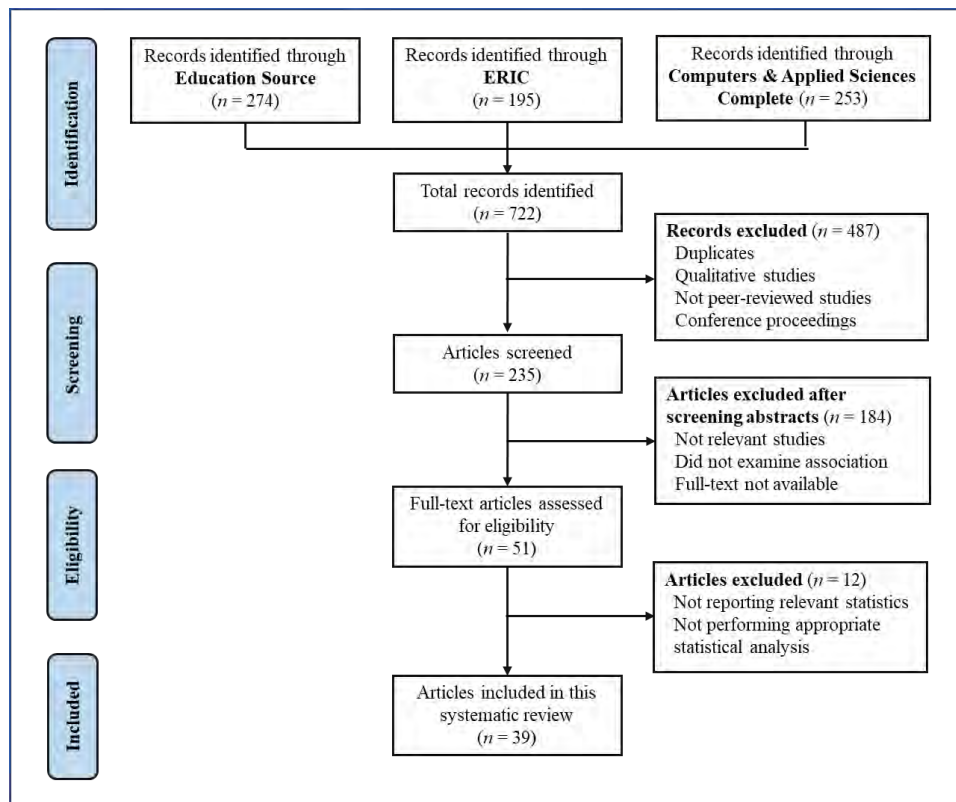
Fig. 1. PRISMA flow diagram

5. Results

Of the studies included for systematic review, the sample sizes ranged from 64 to 10,092 (Mean = 1005.58; SD = 1962.59). The majority of the samples (66.7%) were from Asia. These studies were conducted in 27 countries including India, China, Poland, Malaysia, Turkey, Pakistan, Romania, Indonesia, and Bangladesh. Eight studies were conducted using samples from Europe. Surprisingly, there were only two studies from North America, one study from South America, and one from Africa. The majority of the articles (75%) were published in 2021. The most frequently used statistical technique was statistical equation modelling.

5.1. Overall e-learning service quality–student satisfaction relationship

As shown in Table 2, eight articles examined the effect of the overall ELSQ on student satisfaction during the period of the COVID-19 pandemic. The ELSQ was a second-order construct comprising three elements, namely, technology-related-, instructor-related-, and administration-related dimensions. The results show that the overall ELSQ was strongly and positively associated with student satisfaction with online learning during the COVID-19 pandemic.

Kerzic et al. (2021) presented service quality and system quality as major dimensions of ELSQ. Service quality included administrative, technical, and learning

assistance through tutors, the library, and the teachers' active role in the process of online education with their responsiveness and timely feedback. System quality consisted of the mode of delivery and IT infrastructure. Their study revealed a positive influence of overall ELSQ on student satisfaction. Similarly, Kumar et al. (2021) found that e-learning content was a significant predictor of e-learning quality, which ultimately influenced student satisfaction.

Puriwat and Tripopsakul (2021) proposed and empirically tested e-learning quality as a second-order construct comprising three elements, namely, the course content and design, administrative and technical support, and instructor and learner characteristics. They also found that the overall ELSQ had a significant positive impact on student satisfaction. Saxena et al. (2021) examined four dimensions of ELSQ: assurance, reliability, responsiveness, and website content. The ELSQ strongly influenced learner's satisfaction. In a study by Sumi and Kabir (2021), ELSQ was operationalized as a second-order construct comprising six elements, namely, reliability, responsiveness, assurance, empathy, website design, and learning content, which ultimately had a positive influence on student satisfaction.

Table 2
Studies examining the relationship between ELSQ and student satisfaction

Dimensions	Studies	Frequency
System quality	Agyeiwaah et al. (2022), Ali et al. (2022), Al-Adwan et al. (2021), Chaudhary et al. (2020), Butt et al. (2021), Ejdys (2021), Hoang & Dang (2021), Jiang et al. (2021), Kashive et al. (2020), Parlakkiliç (2022), Saad et al. (2021), Shahzad et al. (2021), Shehzadi et al. (2020), Wang et al. (2021), Zardari et al. (2021), Su & Guo (2021), Magni & Sestino (2021), Nikou & Maslov (2023), Taghizadeh et al. (2022), Thoo et al. (2021) [Not significant], Nguyen (2022) [Not significant]	21
Instructor and course materials quality	Ali et al. (2022), Al-Adwan et al. (2021), Golding & Jackson (2021), Hamdan et al. (2021), Ho et al. (2021), Patwardhan et al. (2020), Saad et al. (2021), Thanasi-Boçe (2021), Thoo et al. (2021), Wang et al. (2021), Wang et al. (2022), Wilczewski (2021), Giray (2021), Su & Guo (2021), Schijns (2021), Magni & Sestino (2021), Han et al. (2021) [Not significant]	17
Administrative and support service quality	Saad et al. (2021)	1
Overall e-learning service quality	Keržič et al. (2021), Kumar et al. (2021), Puriwat & Tripopsakul (2021), Saxena et al. (2021), Sumi & Kabir (2021), Tj & Tanuraharjo (2020), Amin et al. (2022), Suryani & Sugianingrat (2021)	8

5.2. e-Learning service quality dimension—student satisfaction relationship

Table 2 presents the frequencies of the ELSQ dimensions used in the literature. System quality was the most common dimension that positively affected student satisfaction with online learning during the COVID-19 pandemic. Out of the 21 studies that explored an association between system quality and student satisfaction, 19 studies found a positive relationship; however, two studies (Nguyen, 2022; Thoo et al., 2021) reported insignificant association. They concluded that system operations (ease-of-use, performance, interactions with other students and instructors, accessibility and design of the e-learning) had no impact on students' satisfaction in e-learning. Seventeen studies explored the influence of instructor and course materials quality on student satisfaction. Of these, 16 studies reported a positive association; however, in a study by Han et al.

(2021), instructor support was not significantly related to student satisfaction. Surprisingly, only one study (Saad et al., 2021) investigated administrative and support service quality, which was significantly associated with student satisfaction.

5.3. e-Learning service quality subdimension—student satisfaction relationship

In order to answer the third research question (RQ3), two researchers identified and categorized subdimensions within the three ELSQ dimensions from all included studies separately and then compared findings to arrive at common subdimensions. Table 3 presents the breakdown of the main dimensions of the ELSQ that positively impacted student satisfaction into numerous various subdimensions.

Table 3
e-Learning service quality dimensions and subdimensions influencing student satisfaction

ELSQ Dimension	ELSQ Subdimensions	Frequency
System quality	Ease of use (the extent to which a student believes that e-learning platforms are easy to use)	9
	Perceived usefulness (the extent to which a student believes that using e-learning platforms would enhance his or her learning)	7
	Website design, responsive design on the usability of academic websites, learning content, responsiveness, functionality	7
	Technical support and facilitating condition	5
	Relative advantage (the extent to which a student believes that the e-learning system is better than the existing practices)	4
	Perceived compatibility (the extent to which a student believes that the e-learning system is consistent with his or her existing values, needs, and experiences)	4
	Information quality (the quality and relevance of the information that the e-learning system produces)	5
	Perceived enjoyment or pleasure to use e-learning portal, appealing learning website portal	2
	Interactivity (the interactive communication that occurs between the instructor and students within an e-learning system), student-technology interaction (students' interaction with e-learning system to communicate with course content, the course instructor, and other students in the course)	2
	Reliability, assurance, empathy, flexibility, understandable, up-to-date, accurate, relevant, comprehensive, organized	1
	Efficiency, fulfillment, availability, privacy, perspicuity, dependability, stimulation, attractiveness, quality of Internet access, technology access, complexity, confirmation	1
Instructor and course materials quality	Content (learning content and website content) and course materials	10
	Instructor quality	7
	Student-student interaction and collaboration	5
	Instructor-student interaction	5
	Course design	4
	Instructor responsiveness, instructors' response timelines	4
	Instructor support	4
	Academic guidance and counseling	3
	Learner-content interaction (one-way process of accessing, elaborating and reflecting course contents)	3
	Assessment and testing	2
	Instructor motivation	2
	Student autonomy	1
	Instructor innovation, assurance, reliability, lecture delivery method, organization, active role, the instructors' attitude towards e-learning	1
Administrative and support service quality	Administrative assistance and support service	4
	Student advising	1
	Student-administrative staff communication	1

5.3.1. System quality

The technology-related ELSQ sub-components that were frequently used in the literature as predictors of student satisfaction during the COVID-19 pandemic were: perceived ease of use; perceived usefulness; website design attributes such as website content, responsiveness, and functionality; technical support; advantage and compatibility of ICT; and information quality. Fourteen studies examined the impact of perceived usefulness and ease of use on satisfaction. The other subdimensions of ELSQ that significantly influenced student satisfaction were perceived enjoyment or pleasure of using the e-learning portal; an appealing and interactive e-learning website portal; and student–technology interaction. Some system-related attributes, such as reliability, assurance, flexibility, being understandable, up-to-date, accurate, efficient, fulfilment, privacy, stimulation, attractiveness, quality of Internet access, technology access, complexity, and confirmation, were positively related to student satisfaction.

5.3.2. Instructor and course materials quality

The instructor- and course-related ELSQ dimensions that impacted student satisfaction during the COVID-19 pandemic more frequently included content quality, instructor quality, student-student interaction, student-instructor interaction, course design, instructor responsiveness, and instructor support. Ten studies focused on the e-learning interactivity, namely, the student-student and instructor-student interactions. Nine studies examined the effect of the course content on satisfaction. Other factors that significantly affected student satisfaction were: instructor motivation, advising, counselling; assessment and testing; instructor innovation, assurance, reliability; lecture delivery method; organization; and instructor's attitude towards e-learning.

5.3.3. Administrative and support service quality

Surprisingly, only one study examined the impact of administrative and support service quality on student satisfaction. The sub-domains of administrative and support service quality that were positively associated with student satisfaction during the COVID-19 pandemic included administrative assistance, support service, student advising, and the student-administrative staff communication.

6. Discussions and implications

6.1. Theoretical implications

This systematic review contributes to the literature mainly in two ways. As per our knowledge, this was the first systematic review of the quantitative studies that have examined the impact of e-learning service quality on student satisfaction during the COVID-19 pandemic. The paper reviewed and synthesized the extant literature and provided important insights into the overall impact of service quality on student satisfaction with e-learning. The results suggest that e-learning service quality was positively associated with student satisfaction with e-learning during COVID-19 pandemic.

Second, this study used and confirmed the applicability of Pham et al.'s (2019) framework of e-learning service quality. More specifically, the results of the studies

included in this review confirm that in line with Pham et al.'s (2019), the quality of online learning services is composed of three dimensions: (1) e-learning system quality; (2) instructor and course material quality; and (3) administrative and support quality. System quality was the most frequently demonstrated determinant of student satisfaction, suggesting that ICT plays a vital role in virtual learning. This result aligns with previous studies on e-learning (Chopra et al., 2019; Cidral et al., 2018; Kerzic et al., 2021), which found system quality as the main driver of student satisfaction with online learning. Our results, however, contradicts the findings of other studies (Nguyen, 2022; Thoo et al., 2021), which reported a statistically insignificant influence of system quality on student satisfaction with e-learning.

Our study shows that the administrative and support service aspect of e-learning service quality received scant attention. The most frequent system-related subdimensions were perceived ease of use, perceived usefulness, website design and content, responsiveness, functionality, technical support, advantage and compatibility of ICT, and information quality. The most prevalent instructor- and course-related subdimensions were course content and design, instructor quality, student-student and student-instructor interactions, responsiveness, and support.

6.2. Practical implications

The findings from this review provide important insights for college and university administrators, teachers, system managers, and all those involved in developing and implementing effective virtual learning, especially when planning for future pandemics or other similar circumstances.

The results indicate that e-learning service quality dimensions and their sub-components must be given adequate attention in order to enhance student satisfaction with e-learning. Among the three dimensions constituting e-learning service quality, system quality was found to have the strongest influence on students' satisfaction with online learning. As the e-learning system is represented through the university's e-learning website, the quality of the e-learning system can be considered as the quality of the e-learning website and is closely related to the hardware and software technology infrastructure. For the university's e-learning system to operate smoothly and reliably, the hardware and software technology infrastructure needs to be modernized and compatible to meet students' e-learning needs. Higher education institutions should invest more in their ICT equipment and infrastructure for distance learning (e.g., computers, secured and high speed internet connection, digital portal) and equip students, especially first year students, with the skills and knowledge to effectively use the e-learning system (Oladele et al., 2022; Pham & Tran, 2020).

The e-learning system quality's subdimensions identified in this study that affected student satisfaction during the COVID-19 pandemic included: ease of use, security, confidentiality, and accuracy. Ease of use represents the degree to which the navigating function is implemented in a simple way, facilitating students', especially for students participating in e-learning for the first time, interaction with computers or devices connected to the Internet and the necessary information on the e-learning website. Therefore, to enhance learner satisfaction with e-learning, the structure and layout of the content of the e-learning website must be logically displayed and understandable. A well-organized e-learning website with easy navigation will give students a sense of technology readiness and help students become more excited about e-learning.

In order to increase student satisfaction with virtual learning, technology and system managers should also pay special attention to the security and privacy of students' personal/financial information. Student personal and financial information, such as credit/debit card information, are provided in student-university transactions and interactions before, during, and after online classes. If this information is not kept confidential, or is misused, negative consequences for both students and the university can occur. For that reason, universities must regularly upgrade their security algorithms to increase students' trust in the e-learning system.

The accuracy of the e-learning system was an important subdimension contributing to the quality of the e-learning system that can enhance learner satisfaction. Thus, the information displayed on the e-learning website should be logically organized, accessible, accurate, and reliable to help students' complete transactions and interact with online courses in a fast, convenient, and reliable manner.

Another dimension of e-learning service quality identified in this study that enhanced student satisfaction was instructor and course material quality. Hence, universities should recruit high-quality instructors who are passionate about the teaching profession. Specifically, teachers should have both the academic and practical knowledge to make online lectures livelier and more effective. Instructors must know how to motivate students to actively participate in e-learning, create favorable conditions for students to interact continuously (student-faculty interaction, student-student interaction, and interactions between the students and learning materials). When students' learning rights and interests are respected, students become more interested in their learning.

In addition to recruiting and retaining qualified faculty, universities must upgrade their teaching/learning materials and curriculum systems for online teaching and learning. Textbooks and materials should offer both theoretical overviews and practical approaches and must be regularly updated to meet the needs of students' online learning. Collaboration between universities and reputable publishers can be further strengthened to ensure that faculty and students have access to new, modern, and affordable books and educational materials. Synchronizing the e-learning management system of universities with the e-learning system of reputable publishers is a mandatory requirement to create consistency in the management of logins exercises, quizzes, midterms, end-of-term tests, and end-of-course assessments. e-Learning system administrators should pay attention to improving the layout of the system and embedding advanced features to make it more convenient and useful for both lecturers and students (Pham & Tran, 2020).

Finally, while the quality of the e-learning system and the quality of the instructors and teaching materials serve as core services, the quality of administrative and support service is an indispensable factor in contributing to the overall quality of e-learning service and enhancing student satisfaction with virtual learning. Therefore, universities and colleges should implement a student-centered strategy in which students are treated as customers, and their online learning needs should be met with the best quality services. In particular, needs related to information inquiry, program selection, course registration, tuition payment, career counseling, and other administrative procedures must be satisfied by the higher education institutions in a manner that is fast, accurate, and convenient. Universities and colleges should consider providing students with 24/7 virtual services to answer students' inquiries related to online learning, especially in unusual circumstances such as the COVID-19 pandemic.

7.   Limitations and future research

Although this systematic review provided important insights into the service quality-related determinants of student satisfaction with online learning, it also contained some limitations that should be addressed in future research. First, this review analyzed the literature using Pham et al.'s (2019) framework of e-learning service quality as the theoretical basis to examine the associations between the e-learning service quality factors and student satisfaction with virtual learning. Future research can examine the applicability of other models such as teaching and non-teaching service quality (Martínez-Argüelles & Batalla-Busquets, 2016), and teaching quality and administration/support services (Shaik et al., 2006).

Second, this review showed that most studies examined system quality, and instructor and course material quality. Future research should focus on the third dimension of ELSQ, namely, administrative and support service quality. Finally, this study used a systematic review approach to summarize and synthesize the literature. Future research should consider using a meta-analysis technique to combine the effect sizes to evaluate the strengths of the relationships between the ELSQ dimensions and student satisfaction with online learning.

8.   Conclusion

This study represents the first systematic review of the quantitative studies examining the association between e-learning service quality dimensions and student satisfaction with online learning during the COVID-19 pandemic. The findings suggest that e-learning service quality dimensions are significant determinants of student satisfaction. The quality of e-learning systems, instructors, and course materials are dominant predictors of student satisfaction. System-related dimensions such as perceived ease of use, perceived usefulness, website design and content, responsiveness, functionality, technical support, advantages and compatibility of ICT, and information quality affected student satisfaction during the COVID-19 pandemic. Some instructor- and course-related attributes include course content and design, instructor quality, student-student and student-instructor interactions, responsiveness, and support. Thus, colleges and universities must consider system-, instructor-, and course-related dimensions when developing and implementing effective virtual learning, especially in extraordinary situations such as the COVID-19 pandemic.

Author Statement

The authors declare that there is no conflict of interest.

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