

The e-learning perceptions of nursing students during the COVID-19 pandemic: A mixed-methods systematic review

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Abstract. *Background and Objective:* Governments around the world implemented lockdown measures to flatten the pandemic curve of COVID-19 and, as a result, schools, colleges and universities in the highly contagious areas of the world closed and shifted from face-to-face learning to online methodologies. The rapid change in teaching methodology introduced many health professional students to different approaches to learning which can be used anywhere and at any time. The aim of this study is to analyze nursing students' perceptions of e-learning during the COVID-19 pandemic. *Methods:* A mixed-methods systematic review was conducted. We considered PubMed, CINAHL, Scopus, Eric and Business Source Complete. All empirical peer-reviewed studies were included if they investigated perceptions of e-learning education of nursing students during the COVID-19 pandemic, with quantitative, qualitative or mixed-methods design, published between 2020 and June 2022 in English or Italian. The extracted data were combined using a data-based convergent synthesis approach. *Results:* A total of 11 studies were selected. Four themes emerged: promoting valuable learning, challenging experiences and critical perceptions, using online learning in the future and elements affecting e-learning effectiveness. *Conclusions:* This review has explicit and practical recommendations for universities to make advancements in their digital systems not only for students' use but also for teachers. (www.actabiomedica.it)

Key words: nursing students, e-learning, perception, mixed-methods systematic review

Introduction

Since the rapid spread of the COVID-19 pandemic in January 2020, many social and economic dimensions of life and educational systems have changed. Governments around the world implemented lockdown measures to flatten the pandemic curve and, as a result, schools, colleges and universities in the highly contagious areas of the world closed to reduce the effects of COVID-19 and shifted from face-to-face learning to online methodologies (1). The rapid change in teaching methodology introduced many health professional students to different approaches to learning

in virtual environments, the use of online training and digital learning tools and resources, which can be used anywhere and at any time (2). E-learning methodologies can promote easier, faster and more effective access to a wide variety of information by the students; however, in medical education, it can also represent a challenge to both students and teachers. First, changes and development in medical education can cause extra pressure on already overworked faculties (3). Second, aspects such as the lack of face-to-face interactions and opportunities to develop social networks, promote peer support, and change habits can increase feelings of stress, anxiety and depression in students and affect

their learning skills (2). Furthermore, technology issues, such as poor internet connectivity, low video quality, frequent disruption in audio, power interruption, and the lack of face-to-face interaction, may affect the use of technology-based education during an emergency (3, 4). Therefore, while online teaching has the advantage of creating educational opportunities beyond the boundaries of geography and time, academic staff experience greater effort with students' perceptions of uncertain learning (5, 6). Medical education is considered different from other educational domains (7) and often, nursing students experience greater anxiety than other healthcare professionals due to the characteristics of the clinical environment, caring for different kinds of patients, and rigorous courses and practical training (8, 9). Their stress levels can further be affected by online teaching (10), with negative effects on their clinical skills and knowledge (11).

It has been shown that the effectiveness of e-learning depends on the level of user satisfaction and the ability to use the technologies (12). The development of digital literacy skills, computer competence and easy e-learning tools can promote nursing students' learning and improve their satisfaction and perception of online education (2). Despite literature reports on the perceptions and experiences of nursing students with the use of e-learning, to the best of our knowledge, no systematic review has investigated this topic.

Therefore, the purpose of this systematic mixed methods review is to analyze nursing students' perceptions of e-learning during the COVID-19 pandemic.

Methods

Study design

A mixed-methods systematic review was conducted in July 2022. We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement (13) for reporting a systematic review, and the Joanna Briggs methodology for mixed-methods systematic reviews (14). This methodology was adopted because it allows for integrating quantitative and qualitative evidence from different studies and

for responding to a complex review question combining the strengths of different studies (15).

To minimize reporting bias and enhance transparency, we adopted the Enhancing Transparency in Reporting the Synthesis of Qualitative Research guidelines (ENTREQ) (16). This decision was made in consideration of the transformation of all quantitative data into qualitative data, which were then integrated with findings from qualitative studies.

Eligibility criteria

We adopted the PICo (17) acronym to define the research question (18):

1. Population: Nursing students.
2. Phenomena of interest: Perceptions and attitudes on online education, e-learning attitude, online learning and online teaching experiences advantages, and barriers.
3. Context: COVID-19 pandemic time.

Studies were included if they 1) investigated the experiences and perceptions of e-learning education of nursing students during the COVID-19 pandemic; 2) used a quantitative, qualitative or mixed-methods research design; 3) were published in English or Italian; 4) abstracts and full texts were readily available; 5) they were published from 2020 to June 2022.

The exclusion criteria included studies that 1) did not report or explicitly discuss nursing students' experience and/or perception about e-learning during the COVID-19 pandemic; 2) included other healthcare students; 3) investigated teachers; 4) focused on studies about simulation because the strategies used were different from theoretical lessons. Systematic reviews were also excluded, although their reference lists were examined. In addition, within a short period, the volume of publications on topics and issues aligned with the questions of this review has significantly increased. However, the quality and type of these publications often have limitations. This led us to select primary studies from indexed and peer-reviewed journals, enabling us to analyze studies with qualitatively superior data and to exclude gray literature.

Information sources and search strategy

The following databases were explored independently by two researchers (VB and GB): PubMed, Cumulative Index to Nursing and Allied Health (CINAHL), Scopus, Eric and Business Source Complete (EBSCOhost). The two researchers in the first step, independently, selected some studies on nursing students' perceptions of e-learning during the COVID-19 pandemic to identify subject headings and keywords for the search strategy. In the second step, the researchers, under the supervision of a senior researcher (MM), were engaged in discussions in order to reach a consensus on databases selection and search terms. The electronic searches were run between February and March 2022, and the last database consultation was conducted on May 2022. Manual research of the reference lists of included studies was also performed. Medical Subject Headings and key terms were explored, combined with the Boolean operators "AND" or "OR", and modified as necessary for the different databases. Examples of the main key terms were "COVID-19 pandemic", "E-learning education", "Nursing education", "Nursing students", "Online education experience", "Information communication technology", "Distant learning", and "Remote education" (search strategy in supplementary material).

Selection process

Each study will be imported into the RefWorks reference management software to discard duplicates. The reference lists of all identified reports will be analyzed for additional studies. Based on the eligibility criteria, three researchers (BG, VB, RM) will first in blind screen titles, abstracts for inclusion criteria and then their full text. In a meeting the researchers share every information about studies included with the senior researcher. In the case of disagreement concerning the inclusion of a study, an independent assessment will be conducted by a senior researcher (MM) (Table 1). The number of the records removed and reasons for their removal will be reported in the PRISMA 2020 flow diagram for systematic reviews (13).

Data collection process

Two researchers (VB and GB) worked individually and systematically to extract data, adopting a pre-defined matrix that included the following aspects: the author(s), the year of publication, the country where the study was conducted, the study aim(s), the study design and the data collection methodology, and the sample characteristics (number, demographic data and setting). The accuracy and completeness of the data extracted was guaranteed by a third researcher (RM), who checked the entire extraction process.

Data synthesis

The extracted data were combined by adopting a data-based convergent synthesis approach (19), and two phases were adopted as follows (Figure 1):

1. Extracted data were integrated by converting quantitative data into textual descriptions, organized as themes and categories, to integrate them with qualitative data (15), and a thematic analysis was then conducted (20). The included studies were read several times and their meaningful contents were extracted and coded.
2. Adopting an inductive approach, two researchers (GB and VB) critically examined the data, compared similarities and differences, integrated commonalities. Quantitative data extracted from studies were converted into standalone declarative sentences, and integrated with qualitative data directly obtained from qualitative studies (21). The reviewers conducted a thorough examination of the analysed data to identify categories based on similarities in meaning, adhering to the process of meta-aggregation for qualitative synthesis (22). Subsequently, wherever feasible, data were aggregated and synthesized into categories to present the comprehensive integrated findings of the review (15).

Table 1. Characteristics of included studies.

Author, year, country	Aims	Study design	Sample	Data collection methodology
Bester, Smit (33) SOUTH AFRICA	To explore the barriers and enablers for information communication technology adoption in student nurses.	Qualitative, explorative, interpretive and descriptive.	<i>Sample:</i> 17 <i>Data:</i> mean age = 27.8 years, age range 18–46 years, 94% female. <i>Setting:</i> Private nursing education institution in the Free State, South Africa.	Focus group
Diab and Elgahsh (31) EGYPT	To investigate the effect of obstacles faced nursing students on their attitudes towards e-learning while applying it during COVID-19 pandemic.	Quantitative descriptive correlational	<i>Sample:</i> 627 <i>Data:</i> mean age = 19.34 years (SD ± 1.5), age range 19–23 years, 58.9% female. <i>Setting:</i> Faculty of Nursing, Menoufia University, Egypt.	A Structured questionnaire.
Koirala, Silwal (30) NEPAL	To assess the perception of nursing students towards online classes during COVID-19 pandemic.	Quantitative cross-sectional.	<i>Sample:</i> 113 <i>Data:</i> mean age 22.3 years (SD ± 2.9) <i>Setting:</i> Nursing students at Gandaki Medical College of Nepal	Semi-structured questionnaires.
Salmani, Bagheri (32) IRAN	To describe the Iranian nursing student experience of e-learning during the COVID-19 pandemic.	Qualitative descriptive.	<i>Sample:</i> 10 <i>Data:</i> N.D. age, 6 females. <i>Setting:</i> Undergraduate nursing student from an Iranian university	In-depth individual audio recording interviews.
Schuler, Tyo (35) USA	To examine student perceptions about online educational programmes (OEPs).	Quantitative cross-sectional correlational, and qualitative with content analysis method by Graneheim and Lundman (40).	<i>Sample:</i> 211 <i>Data:</i> age range 17→26 years, 89.6% female. <i>Setting:</i> Registered nurses and Bachelor of Science in Nursing students	The perception of online educational tools (POET) scale (35) and data from the open-ended questions.
Sharma, Adhikari (34) NEPAL	To assess nursing students' satisfaction with emergency distance learning.	Quantitative cross-sectional.	<i>Sample:</i> 200 <i>Data:</i> N.D. <i>Setting:</i> 5 nursing campus of Tribhuvan University.	A structured questionnaire.
Smith, Chen (36) USA	To examine perceptions of online teaching effectiveness from nursing students' and faculty's perspectives.	Qualitative descriptive.	<i>Sample:</i> 17 <i>Data:</i> mean age = 20 years, age range (24–56 years), 82.4% female <i>Setting:</i> College of Nursing in a Midwestern public university	Focus group interview.
Soriano and Oducado (37) PHILIPPINES	To examine nursing students' attitudes towards e-learning in two selected nursing schools in the Philippines.	Quantitative cross-sectional.	<i>Sample:</i> 111 <i>Data:</i> The mean age was 20.17 years, 67.6% females. <i>Setting:</i> Second-year nursing students in two nursing schools (one public and one private) in the Philippines.	A structured questionnaire.

Author, year, country	Aims	Study design	Sample	Data collection methodology
Subedi, Nayaju (29) NEPAL	To assess the impact of E-learning during the COVID-19 pandemic among nursing students and teachers of Nepal.	Quantitative cross-sectional.	<i>Sample:</i> 1,012 <i>Data:</i> mean age NR, 40.5%, age range (20–24 years), 100% female <i>Setting:</i> 13 different nursing colleges in Nepal	A structured questionnaire.
Thapa, Bhandari (38) NEPAL	To identify the nursing students' attitude towards the practice of e-learning during COVID-19.	Quantitative cross-sectional.	<i>Sample:</i> 470 <i>Data:</i> mean age = 20.91 ± 1.55 years, age range (20–25 years) <i>Setting:</i> Four nursing colleges as College of Medical Sciences, Kathmandu University (CMS-KU), Chitwan Medical College, Tribhuvan University (CMC-TU), Pokhara Nursing College, Pokhara University (PU), and Shree Medical and Technical College, Purbanchal University (SMTC-PurU) in Nepal	A structured questionnaire.
Wallace, Schuler (39) USA	To explore preclicensure nursing students' experiences of the transition to remote learning during the spring 2020 semester.	Qualitative descriptive phenomenological.	<i>Sample:</i> 11 <i>Data:</i> mean age = 24.6 years, 90.9% female <i>Setting:</i> Baccalaureate programme in the Pacific Northwestern United States	Interview and online video meeting platform.

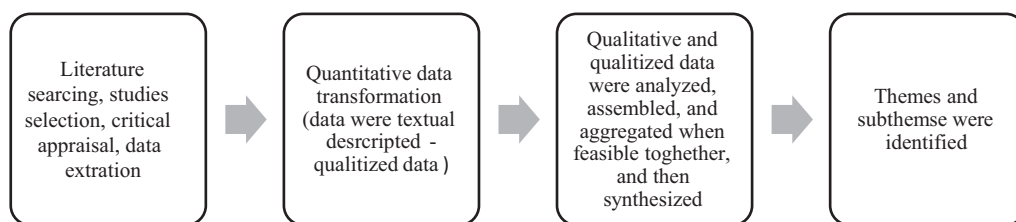


Figure 1. Graphic representation of the approach used to synthesize the data.

- Adopting a thematic approach (23), the same researchers analysed, compared and grouped the key concepts according to their similarities and differences to identify themes and sub-themes (24, 25). Their frequency was also verified to guarantee that the identified themes and subthemes adequately described the original data.

Quality appraisal

The methodological quality of the selected studies was evaluated by adopting a Mixed-Methods Appraisal Tool (MMAT) (26). Two researchers (VB and GB) assessed the quality of the studies included independently, and any discrepancies were resolved through discussion (Table 2). According to the

Table 2. Quality assessments of the included studies using the Mixed-Methods Appraisal Tool (MMAT).

Category of study design	Methodological quality criteria	Bester, Smit (33)	Diab and Elgahsh (31)	Koirala, Silwal (30)	Salmami, Bagheri (32)	Schuler, Tyo (35)	Sharma, Adhikari (34)	Smith, Chen (36)	Soriano and Oducado (37)	Subedi, Nayaju (29)	Thapa, Bhandari (38)	Wallace, Schuler (39)	
Screening question	S1. Are there clear research questions?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
	S2. Do the collected data address the research questions?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
	1. Qualitative design	1.1. Is the qualitative approach appropriate for answering the research question?	Yes			Yes	Yes		Yes				Yes
		1.2. Are the qualitative data collection methods adequate for addressing the research question?	Yes			Yes	Yes		Yes				Yes
		1.3. Are the findings adequately derived from the data?	Yes			Yes	Yes		Yes				Yes
2. Quantitative descriptive	1.4. Is the interpretation of the results sufficiently substantiated by the data?	Yes			Yes	Yes		Yes				Yes	
	1.5. Is there coherence between qualitative data sources, collection, analysis and interpretation?	Yes			Yes	Yes		Yes				Yes	
	4.1. Is the sampling strategy relevant to addressing the research question?		Yes	Yes		Yes	Yes		Yes	Yes	Yes		
	4.2. Is the sample representative of the target population?		Can't tell	Can't tell		Can't tell	Can't tell		Can't tell	Can't tell	Can't tell		
	4.3. Are the measurements appropriate?		Yes	Can't tell		Can't tell	Can't tell		Can't tell	Can't tell	Can't tell		
4.4. Is the risk of nonresponse bias low?		Yes	Yes	Yes		Yes	Yes		Yes	Yes			
4.5. Is the statistical analysis appropriate to answer the research question?		Yes	Yes	Yes		Yes	Yes		Yes	Yes			

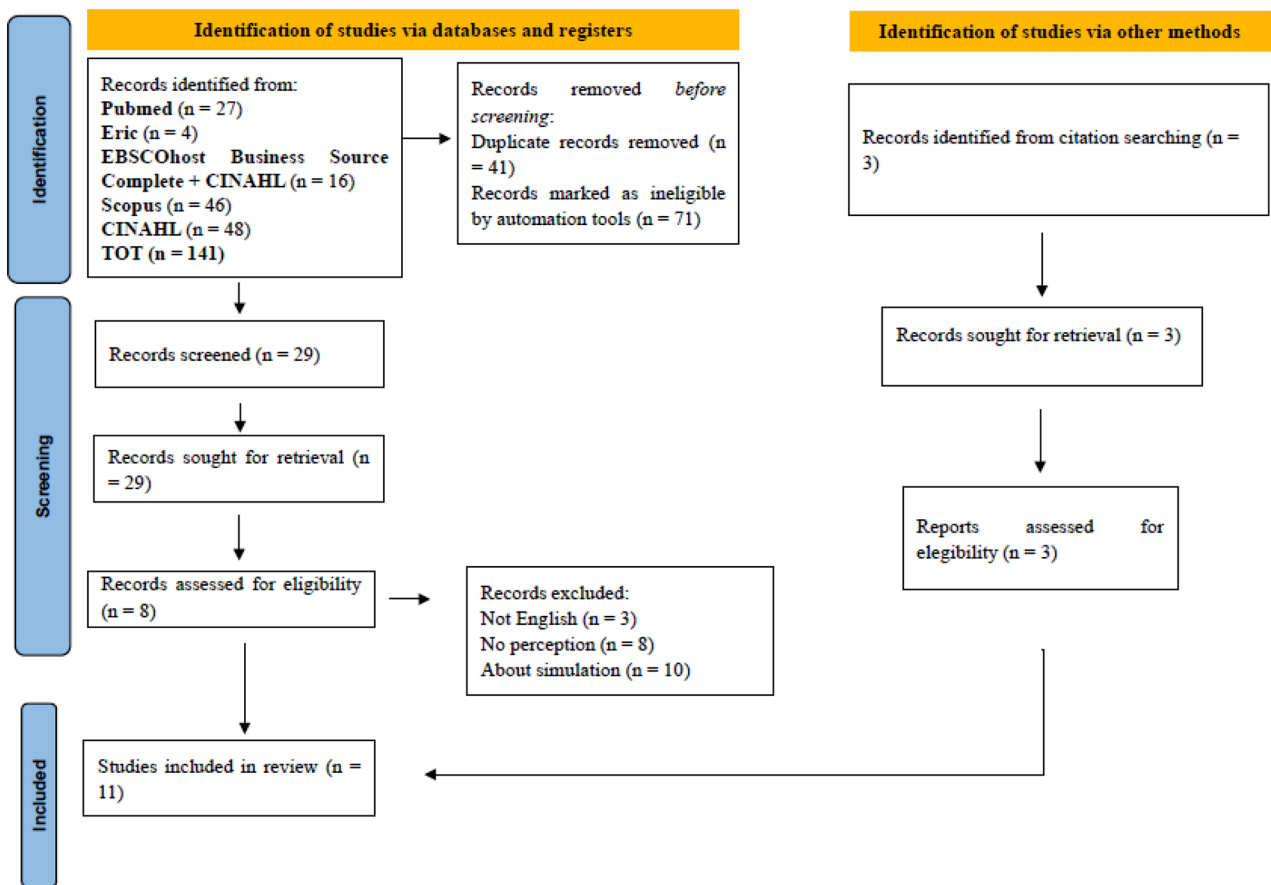


Figure 2. Flow diagram.

aim and the explorative nature of this review, the quality of the included studies was assessed to explore their possible contributions to the synthesis (27). Therefore, the methodological quality assessment was conducted to support the interpretation and evaluation of the findings of the selected studies (28), and not as an exclusion criterion.

Results

Study selection

A total of 141 citations were identified through database searches. Of these, 112 studies, including 41 duplicates and 71 publications, were excluded by three researchers (VB, RM and GB) who evaluated titles and abstracts of potential eligible studies individually

and then agreed upon the findings. The remaining 29 studies were further selected, and their full texts were read by the same researchers. In cases of evaluation disagreements, a consensus was reached among the researchers through discussion. At the end of the selection process, 11 studies were included (Figure 2).

Study characteristics

A total of 11 studies were selected involving nursing students (Table 1). The studies were published from 2020 (29-31) to 2022 (32); however, the majority were published in 2021 (33-39). Four studies were conducted in Nepal (29, 30, 34, 38), three in the USA (35, 36, 39), and one each in the Philippines (37), Egypt (31), Iran (32), and South Africa (33).

Overall, a cross-sectional design was adopted in five studies (29, 30, 34, 37, 38), a descriptive

correlational design was used in one study (31), four studies employed a qualitative design (32, 33, 36, 39), and one study adopted a quantitative design, but some of the data were analysed using a qualitative approach (35).

The qualitative study designs were descriptive in two (32, 36), qualitative, explorative, interpretive and descriptive in one (33), and qualitative descriptive phenomenological in one (39). In the qualitative studies, a total of 55 students were involved, with a mean age of 24 years and a range of 18–56 years; the researchers involved predominantly female subjects ranging from 82.4–94%. Regarding the quantitative studies, an overall sample of 2,744 students was enrolled with a age range of 17–26 years and involved predominantly female subjects ranging from 58.9–100%. The study of Smith, Chen (36) e Subedi, Nayaju (29) takes into consideration data from students and faculty; for our analysis, we considered only data on students' perceptions.

In three quantitative studies, researchers analyses students' attitudes on online learning (31, 37, 38), in two studies, the impact/perception of online teaching on nursing students (29, 30), and one study analyses the satisfaction with distance learning (34). Schuler, Tyo (35) which adopted a quantitative and qualitative study design analyses the perception about online educational programmes. In three qualitative studies researchers analyses experience/perceptions toward e-learning (32, 36, 39), in one study the barriers for information, communication technology adoption (33) (Table 1).

Quality appraisal

Overall, the methodology quality of the selected studies was high and their data collection, sample characteristics and recruitment were appropriate. In the qualitative studies (33, 36), the research questions were clearly stated, and in one (32) the criteria adopted to obtain data validity and reliability were reported. In all study designs, the data collection methodology was explained, and they were considered adequate to address the research question. The findings were adequately derived and sustained by the data.

For the quantitative studies, the sample sizes varied from 111 (37) to 1,012 (29), three authors used a power analysis (35, 37, 38) and one a stratified random sample (31). Every questionnaire was not considered for validity; however, in some studies (30, 31, 38) the reliability was evaluated. In addition, in every quantitative study, the population represented a local situation and could not be considered representative of the target population (Table 2).

Emergед themes

Four themes emerged from the selected literature: "Promoting valuable learning", "Challenging experiences and critical perceptions", "Using online learning in the future", and "Elements affecting e-learning effectiveness" (Table 3).

Theme 1. Promoting valuable learning

Promoting valuable learning emerged from nine studies (29, 31-33, 35-39). One key aspect was related to technology benefits, while the other was related to learning and relationships with faculty. The students perceived that the technology offered them the opportunity to access and the possibility to relisten to the lectures anytime and anywhere (29, 32, 33, 36, 39); the students also outlined that online classes saved time and cost and provided them the possibility to have all materials organised (29, 31-33, 35-39). Another key aspect was the students' roles and relationships with their faculties (29, 31, 33, 35-37, 39). In particular, many students reported that e-learning promoted critical thinking (35), offered self-assessment for exam preparation (33), and provided immediate feedback (33) and response to their questions (36); moreover, e-learning enhance learning efficiency, encourage to search additional information, and make the learning process easier (31). The students also reported possibilities of studying with peers (39) and perceived e-learning as a motivational modality because the teachers demonstrated passion and enthusiasm for the subjects and articulated clear student expectations for the courses and assignments. They also supported students in doing their best and keeping going during

Table 3. Emerged themes.

Themes	Description	Key aspects	Studies
Promoting valuable learning	Students perceived advantages from technology use.	Benefits of technology: <ul style="list-style-type: none"> Facilitated and fast access to information anywhere and anytime. Benefits of exposure to various types of technologies Possibility of reviewing and re-listening to recorded lectures and other presentations as desired. 	Bester, Smit (33) Salmani, Bagheri (32) Smith, Chen (36) Subedi, Nayaju (29) Wallace, Schuler (39)
	Students declared technological conveniences with online learning.	An easy and useful system <ul style="list-style-type: none"> Online classes save time and costs Flexibility of remote learning The convenience of having all learning materials organised into one online course. The possibility of efficiently managing time Enjoy taking class from home rather than from school 	Bester, Smit (33) Salmani, Bagheri (32) Schuler, Tyo (35) Smith, Chen (36) Soriano and Oducado (37) Subedi, Nayaju (29) Thapa, Bhandari (38) Wallace, Schuler (39) Diab and Elgahsh (31)
	Students declared learning conveniences with e-learning.	Main benefits of e-learning <ul style="list-style-type: none"> Enable self-assessment for exam preparations and the possibility to re-do assignments multiple times until mastery or the desired grade is achieved Immediate feedback on learning and timely responses to questions Some programmes enhance learning and the ability to think critically The possibility of forming groups of study through social media platforms with peer-to-peer interactions Individualised learning activities motivate students to learn Prompt students' resourcefulness and creativity Promote learning experiences and the ability to think critically Enhance learning efficiency Encourage to search additional information Enhance my success in learning Enable to accomplish the learning activities more quickly Make the learning process easier Handle the learning content easier 	Bester, Smit (33) Schuler, Tyo (35) Smith, Chen (36) Soriano and Oducado (37) Wallace, Schuler (39) Diab and Elgahsh (31)
	Students perceived easy relationships and communication with faculty.	Relationship and communication with faculty <ul style="list-style-type: none"> Faculty communication to help students understand linkages between courses, learning objectives, course contents, learning activities, and real-life situations was seen as a hallmark of online teaching effectiveness. Individualised communication that helped them feel supported by and connected to the instructor Awareness of faculty presence as an important motivator Ease of contacting and communicating with instructors 	Smith, Chen (36) Subedi, Nayaju (29) Diab and Elgahsh (31)

Themes	Description	Key aspects	Studies
Challenging experience and critical perceptions	Students perceived technological disadvantages with e-learning.	Connectivity and Technology issues <ul style="list-style-type: none"> Limited access to computer devices and connectivity (internet and intranet) Technical issues Reduced interactions with patients Expensive and physical energy and time consumption Absence of tools for students on how to operate the e-learning system Frustration at the number of platforms required and anxiety because of the inability to use e-learning effectively Lack of competence to enter the e-learning systems/ platforms and the need for advanced technical knowledge of computer use Lack of support service as tutors High cost of internet fees from the private café 	Bester, Smit (33) Salmani, Bagheri (32) Schuler, Tyo (35) Soriano and Oducado (37) Subedi, Nayaju (29) Thapa, Bhandari (38) Wallace, Schuler (39) Diab and Elgahsh (31)
	Students perceived physical disadvantages from technology use.	Physical and psychological concerns <ul style="list-style-type: none"> Eye problems/headaches Anxiety, stress and frustration over technical issues and effectiveness of e-learning methods Social isolation Distraction in the learning environment Difficult communication with teachers during online classes. Concerns about the steep learning curve and the efficacy of e-learning methods. Learning on the internet outside of class is less motivating than a regular course. Difficulties sharing ideas with colleagues in online learning Low participation and concentration during online learning Lack of interaction during online classes Concerns about asking questions and approaching professors Fear of developing weaknesses in professional skills 	Koirala, Silwal (30) Salmani, Bagheri (32) Smith, Chen (36) Soriano and Oducado (37) Subedi, Nayaju (29) Thapa, Bhandari (38) Wallace, Schuler (39) Diab and Elgahsh (31)
	Students declared negative aspects of e-learning.	Perceived consequences of e-learning courses <ul style="list-style-type: none"> Superficial learning Lack of supervision and self-discipline Low relationships between faculty and students Low sense of responsibility during exams Different family members' expectations Interferences with household chores and responsibilities 	Bester, Smit (33) Salmani, Bagheri (32) Thapa, Bhandari (38) Wallace, Schuler (39)
Also using online learning in the future	Students are aware about the advantages of technology for future learning; however, they prefer learning through traditional teaching methods.	Students' perspectives <ul style="list-style-type: none"> Face-to-face education is more recommended than e-learning It is not considered necessary repeat online classes once usual classes restarted Traditional learning is considered better than online learning 	Bester, Smit (33) Koirala, Silwal (30) Sharma, Adhikari (34) Thapa, Bhandari (38)

Themes	Description	Key aspects	Studies
Elements affecting e-learning effectiveness	Students declared compliance with teaching strategies used with e-learning.	Professors teaching strategies <ul style="list-style-type: none"> • Knowledge of the content of the area of expertise and of online teaching strategies • The use of stories and examples based on the instructor's experiences • Communication and teaching styles • Time devoted to responding to students' questions, course announcements, individual communication • Engagement abilities • Use of strategies such as synchronous lectures or discussions, slide presentations accompanying lectures. • Use of clear, easy-to-follow and meaningful lecture contents. • Flexibility with assignments • Clear expectations and guidelines • Use of discussion forums • Clear assignment directions in the syllabus • Availability of all course materials • The quality of lessons • Effective teaching method 	Salmani, Bagheri (32) Schuler, Tyo (35) Sharma, Adhikari (34) Smith, Chen (36) Diab and Elgahsh (31)

the more challenging parts of the courses, following up with students when they were underperforming, and presenting information in various ways to enhance learning (36). In addition, communicating and relating with faculty members was easier (29, 36) because reaching them was not difficult (29, 36). Students understood the linkages between learning objectives, content and real-life situations better (36), and they could also hear more stories and examples based on the instructor's experiences (36).

Theme 2. Challenging experiences and critical perceptions

Challenging experience and critical perceptions were reported in ten studies (29-33, 35-39). Reported negative aspects of technology use included limited access to connectivity, lack of competence in using platforms and frustration about the inability to efficiently use e-learning systems (29-33, 35, 37-39). Furthermore, problems with power outages, internet interruptions, having no laptops, mobile phones without advanced technology, no access to reference books (32), electricity problems (29, 31, 38), and lack of support service as tutor (31) were also reported.

Other reported critical issues were physical and learning problems: the students suffered from physical and psychological problems, such as tired eyes and headaches (29, 38), anxiety, stress (38), social isolation and feelings of loneliness (38, 39) and interferences with household responsibilities (32). The students' perceptions of learning problems included superficial learning (32, 33), lack of supervision and self-discipline (32) and a low sense of responsibility during exams with cheating on e-learning exams and sharing of homework (32). Contrary to what was shared in the positive aspects of online education, some students reported low student-teacher interactions (37, 39), lack of feedback from professors (32) and feelings of pressure from teachers for research and learning activities (38).

Theme 3. Using online learning in the future

Four studies described the students' perspectives about e-learning (30, 33, 34, 38). The students preferred face-to-face education over e-learning and would not consider using online classes in any situation once usual classes resume (30, 33, 34, 38). Therefore, despite its use in some situations, e-learning cannot replace traditional face-to-face teaching (34).

Theme 4. Elements affecting e-learning effectiveness

Five studies (31, 32, 34-36) found strategies that faculty members could adopt to promote effective learning. Specifically, teachers should use stories and examples based on their experiences (36), adopt synchronous lecture strategies (36), use discussion forums (36), pay attention to their tone of voice, the quality of audio and the style of presentations during the lessons to improve their quality (32). Promoting a clear dialogue with students (36), making all course materials available (34) and adopting various instructional techniques (31, 35) were other suggested strategies.

Discussion

The purpose of this systematic review was to analyse nursing students' perceptions of e-learning during the COVID-19 pandemic. In the selected literature, various advantages of e-learning methodologies were reported, such as the flexibility and accessibility to teaching materials and lectures and the possibility of using different technologies to attend lessons (29, 32, 33, 36, 39). Furthermore, students perceived that online learning saved time and cost and offered them the possibility of organising their learning materials better (29, 31-33, 35-39). According to Naciri, Radid (41) this finding could be explained by the students' acknowledgment that this methodology served as a viable substitute for in-person lessons amid the proliferation of the virus. Furthermore, positive perceptions could also be explained by many advances in recent years regarding the use of online platforms in health science education, the accessibility of technology and the improved quality of online courses (42). On the other hand, nursing students also described negative perceptions and diverse weaknesses of online education, such as internet connectivity and technical issues, lack of contact with and feedback from instructors/teachers, and other students (29, 31-33, 35, 37-39). In line with our findings, other studies conducted during the pandemic in non-nursing students reported similar results (43, 44).

In addition, students reported negative physical and psychological consequences such as headaches, anxiety and stress because of extended use of the

technology (29, 30, 32, 36-39). In another study (45) has reported in part that these situations could be related to the different technological infrastructure and levels existing in each country and students' personal resources (46). Moreover, many students connected their negative perception of the use of e-learning methodology to their teachers' lack of preparation in the management of the platforms and the lesson quality (39). The COVID-19 pandemic resulted in a widespread period of lockdown, during which the universities closed globally. This extraordinary condition compelled faculties and university organisations to quickly promote alternative pedagogical approaches and teaching modalities (47). As a result, the use of e-learning strategies and various online platforms increased to guarantee distance teaching and learning activities (47). Before the pandemic, in-person lessons were the most predominant teaching practices, while e-learning and the use of online platforms were often considered complementary teaching alternative methodologies, even in many developed countries (48). Online teaching methodologies increased rapidly after the beginning of the pandemic, even in developing countries (48), although they were not adequately prepared for such a radical change. Having passed this stage and thinking about the future, the experience gained by universities in recent years can support activities aimed at improving students' psychological motivation, promoting their peer collaboration and community support. They could also be used to improve student engagement in a digital environment, promoting new interaction strategies with instructors, supporting their cognitive problem solving and learning management development. This means that faculties need to improve attitudes and the adoption of e-learning systems for nursing students, promoting specific training, a robust orientation, and sensitisation to enhance digital literacy. Furthermore, universities need to invest in internet policy reforms that, for example, address the cost of acquiring technological equipment and invest more in technological infrastructure, especially in developing countries.

Another aspect reported in the selected studies was the ambivalent perceptions of the students regarding the effectiveness of e-learning methodologies. In some studies, (32, 33, 38, 39) students reported that

online courses promoted superficial learning and that teacher supervision was often lacking, resulting in some students exhibiting a low sense of responsibility during exams and assessments. Conversely, students found that online teaching facilitated their self-assessment for exam preparation, offered immediate feedback from teachers, and improved their critical thinking abilities and enhance learning efficiency and make the learning process easier (31, 33, 35-37, 39).

The benefits of using various teaching strategies and reporting experience-based stories and examples during discussion boards were also reported as positive teaching strategies (32, 34-36). The rapid change from traditional teaching methodologies to online learning represented a challenge for educators in terms of time constraints and computer literacy (49). Consistent with previous literature (50), our results confirm that issues such as knowledge and skill deficits, personal and institutional resource limitations, support and attitudes are examples of barriers that affect online learning. In addition, when the relationships and communication styles with faculty were effective, the students were positively impressed and felt supported and motivated (29, 36). Some studies (32, 34-36) have confirmed that the effectiveness of learning depends on teachers' communication and teaching styles. According to Rahm, Tollner (51), e-learning lessons and materials should be designed to adopt relevant and authentic information for the learners and should include intuitive navigation systems. Meaningful and adaptive feedback strategies, incorporated into real-life experiences, are other suggested strategies.

Students' perceptions of social isolation and loneliness are worthy of note (38, 39) as this topic is well known in the literature (52). In their systematic review, Downer, Gray (53) underlined how distance learners experienced feelings of anxiety and isolation when studying remotely before the pandemic while using an electronic environment alleviated these issues by offering different types of teaching methodologies. Although it is difficult to imagine that technology could fully substitute for all aspects of face-to-face socialisation (54), the promotion of collaborative e-learning systems may mitigate feelings of isolation. The use of social media platforms with peer-to-peer interactions for academic purposes (33, 35-37, 39) where students

could discuss both academic and non-academic activities without being constrained by space and time could be a good strategy for reducing anxiety and feelings of loneliness among students.

Finally, students opined that face-to-face education is better and more commendable than online learning; however, they did not exclude the use of online teaching in some situations (30, 33, 34, 38). Online learning methods should be considered in the future for meeting with students, teachers and academic staff, for sharing information or to discuss decisions. Thus, with e-learning, the COVID-19 pandemic emergency has offered a great form of learning structure for educational purposes.

There are some limitations to this study. We considered only a few databases; therefore, we could not take all the studies about nursing students' perception with e-learning into consideration.

We limited our research to primary studies published in indexed journals and written in English and Italian. Studies published in other languages were excluded, and grey literature was not searched; therefore, information bias might have been introduced. In addition, this review has a limited generalisation to nursing students.

Conclusions

This review's findings highlight the negative and positive perceptions of nursing students about technology use and didactical strategies. Therefore, we believe that this study largely answered our research question. Universities have learnt from the COVID-19 emergency pandemic growing in their strategies for helping students adapt in the future. This review has had some explicit and practical recommendations for universities, such as the necessity to advance digital system use not only for students but also for teachers and the opportunity to consider digital systems in the future for limited didactical occasions, while prioritising face-to-face teaching.

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