Original Article

Opportunities and Threats of E-Learning in Nursing Education: An Overview of Reviews

Mahdieh Arian[1,2] , Mohammad Bagher Oghazian[3] , Seyyed Reza Mazlom[1,2] , Nazila Zarghi[1,2] , Sedigheh Abdollahpour[1*]

[1]Nursing and Midwifery Care Research Center, Mashhad University of Medical Sciences, Mashhad, Iran

[2]Department of Medical-Surgical Nursing, School of Nursing and Midwifery, Mashhad University of Medical Sciences, Mashhad, Iran

[3]Department of Internal Medicine, Faculty of Medicine, North Khorasan University of Medical Sciences, Bojnurd, Iran

Abstract

Introduction: E-learning is increasingly replacing traditional methods in medical science education. The main purpose of this study is to identify opportunities, threats and required components of E-learning in nursing education.

Methods: We conducted a comprehensive systematic review following Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines, searching Web of Science, Scopus, ProQuest, Cochrane Library, ScienceDirect, Medline/PubMed, Google Scholar, and SID, Irandoc, and Magiran databases without time or language restrictions. Two researchers assessed each systematic review using A Measurement Tool to assess systematic Reviews (AMSTAR). This overview includes 47 reviews published until the end of 2022.

Results: Electronic education in nursing offers opportunities categorized into 10 areas: accessibility and flexibility, efficiency and effectiveness, strengthening clinical competencies, features of electronic education, improving educational processes, improving the quality of education, evaluation and feedback, diversity and practically of content, setting learning environment and promotion of nursing professors' role. However, there are also challenges, grouped into 10 categories: challenges of evaluation and feedback, problems related to the of human resources development, structural and technical limitations, challenges related to communication and interaction, challenges related to the content of education, financial challenges, organizational challenges, cultural challenges, challenges of professional competence, challenges of ethics and information security. The essential components for effective electronic teaching in nursing education are organized into 6 categories: technological infrastructure, human infrastructure, pedagogical infrastructure, cultural and social infrastructure, economic infrastructure, and management and leadership infrastructure.

Conclusion: E-learning offers an efficient and effective training method for nurses that should be embraced given advances in science and technology. Addressing infrastructure limitations will further enhance its benefits.

Introduction

The digital transformation of education and information technology has established smart learning environments worldwide. The online education market is projected to reach $325 billion by 2025, tripling its value since 2015.[1] Consequently, organizations, universities, researchers, and educators are increasingly focusing on educational technologies.[2] The COVID-19 pandemic forced classroom closures globally, presenting unprecedented challenges, particularly in health science education, which had to shift to remote learning to protect medical and nursing students from potential COVID-19 exposure. This sudden transition affected 1.5 billion students and 63 million educators, revealing both strengths and weaknesses in educational systems amidst digitalization.[3]

E-learning in medical education is rapidly gaining ground as a viable alternative to traditional methods.[4] A 2018 Cochrane review indicated that e-learning's effectiveness is similar to traditional teaching, while other studies highlight numerous advantages, including on-demand access, control over content quality, and learning analytics.[5] Nursing students must acquire the competencies required for safe, compassionate, and ethical care across various settings.[6] Nursing education is also characterized by continuous professional development, promoting lifelong learning.[7]

Integrating innovative techniques not only enhances clinical learning within limited time frames but also supports nurses' self-directed training and skill enhancement.[6,8] Given that nurses constitute one of the largest professional groups in healthcare, it is crucial to investigate e-learning extensively within this field.[6] Most pre-COVID-19 studies on nursing e-learning primarily focused on participant satisfaction rather than skill improvement or changes in practice post-intervention.[9,10] A pre-pandemic review of the field was not comprehensive in addressing e-learning's opportunities and challenges.[11,12] Therefore, with the shift toward electronic education and its cost-effectiveness, as well as the long-term impacts of crises like COVID-19, there is a pressing need for a new review of existing studies. This research aims to identify opportunities, threats and required components of E-learning in nursing education.

Material and Methods

This overview aims to identify the opportunities and threats of e-learning in nursing education based on the PRISMA systematic review and meta-analysis protocol. The structured questionnaire (PICOS) encompasses the following elements: Participants (nursing students, clinical nurses, professors, and instructors), Intervention (e-learning), Comparisons (traditional educational methods), Outcomes (opportunities, threats, and influencing factors), and Study Design (review studies with or without meta-analysis). A comprehensive and regular search without time and language restrictions was conducted in Web of Science, Scopus, ProQuest, Cochrane library, Science Direct, Medline/PubMed and Google Scholar and SID, Irandoc and Magiran database. In each of the databases, depending on how to search, articles were retrieved using the following keywords: ("e-learning" OR "digital learning" OR "Web-based learning" OR "online learning" OR "distributed learning" OR "computer assisted instruction" OR "Internet-based learning" OR "virtual mentor" OR "virtual learning") AND ("healthcare education," "medical education," "nursing education") ("computer" OR "web" OR "internet" OR "online" OR "information technology" OR "mobile" OR "phone*" OR "personal digital assistant*" OR "handheld*" OR "tablet*") AND ("learning" OR "education" OR "instruction" OR "problem solving") AND ("nurse* student*" OR "student* nurse *"). The period of retrieval and search of articles was unlimited, and considering the inclusion criteria, articles published until the end of 2022 were included in the study. There were no restrictions on language.

Eligibility criteria included studies that examined the opportunities and threats of learning in nursing education, specifically those involving nursing students and faculty, or those involving healthcare professionals that included nurses. Non-review studies and those irrelevant to the objectives were excluded. The PRISMA flowchart (Figure 1) illustrates the article selection process. Based on the initial search, 790 articles were retrieved, after reviewing the titles and abstracts, 489 articles were removed and 301 articles remained. In the re-examination and based on the inclusion criteria, 83 articles were excluded, and after qualitative assessment, 47 articles were identified that addressed the challenges, opportunities, and essential components of electronic education in nursing. Two researchers independently conducted the searching and screening, resolving any disputes with a third researcher. Finally, data was extracted into a form that included the article's author, year of publication, title, purpose, type of review, results, and quality evaluation score. Each systematic review was assessed by two reviewers using A Measurement Tool to assess systematic Reviews (AMSTAR), which consists of 11 questions scored as Yes (1) or No (0). Scores of 8-11 indicate high quality, 4-7 medium quality, and 0-3 low quality.[13]

Results

In this overview of reviews study which is a comprehensive review of systematic reviews, three categories of results were extracted under the headings of advantages or opportunities, challenges or disadvantages, and required components of e-learning in nursing education. The first category, shown in Table 1, presents the opportunities or advantages of e-learning in nursing education. The second category, shown in Table 2, presents the challenges or disadvantages of e-learning in nursing education. The third category, shown in Table 3, presents the required components of e-learning in nursing education. All articles from 47 systematic reviews published between 2006 and 2022 were reviewed, and the characteristics of the studies reviewed are summarized in Table 4. This table lists characteristics such as first author, year of publication, purpose of the study, database searched, electronic training, and participants. The diversity of keywords of the selected studies is shown in Figure 2. As can be seen, the concepts of electronic education in nursing have gained more strength since 2014. In Figure 3, the names of authors who collaborated on different studies are displayed. The opportunities and benefits of electronic education in nursing education were obtained in 10 categories with the titles: accessibility and flexibility, efficiency and effectiveness, strengthening clinical competencies, features of electronic education, improving educational processes, improving the quality of education, evaluation and feedback, diversity and practically of content, setting learning environment and promotion of nursing professors' role. The highest level of impact was related to the benefits of "accessibility and flexibility" with a score of 68, and the lowest was related to "learning environment" and "promotion of nursing professors' role" with a score of 5. The advantages are presented in Figure 4. Challenges and disadvantages of
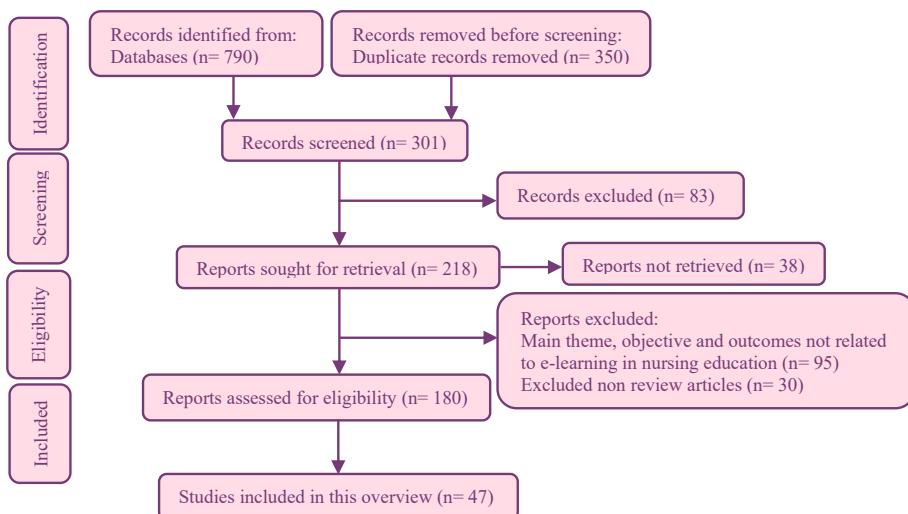
Figure 1. PRISMA flow diagram

electronic education in nursing education were obtained in 10 categories with the titles: challenges of evaluation and feedback, problems related to the of human resources development, structural and technical limitations, challenges related to communication and interaction, challenges related to the content of education, financial challenges, organizational challenges, cultural challenges, challenges of professional competence, challenges of ethics and information security. The highest level of impact on disadvantages was related to "challenges related to communication and interaction" with a score of 59, and the lowest was related to "organizational challenges" and "challenges ethics and information security" with a score of 4. Disadvantages are introduced in Figure 5. The required components of electronic teaching in nursing education were obtained in 6 floors with the titles: technological infrastructure, human infrastructure, pedagogical infrastructure, cultural and social infrastructure, economic infrastructure, management and leadership infrastructure. The highest level of impact in the required components is related to "Management and Leadership Infrastructure" with a score of 53 and the lowest is related to "Economic Infrastructure" with a score of 6. The required components are introduced in Figure 6.

Discussion

The present study has been conducted with the three aims of identifying the advantages, disadvantages, and required components of electronic education in nursing. In general, in the two categories of advantages, disadvantages, access and flexibility (68 points) and strengthening of clinical competencies (64 points), communication and interaction (59 points), and structural and technical limitations (42 points) scored the most points. Also, in the required components, management and leadership infrastructure (53 points) and technology infrastructure (38 points) had the highest scores. One of the results obtained from

the benefits of e-learning, in line with Naciri's study, is accessibility, which can be useful in three areas (content, training, and location) and along with flexibility, it gives nurses the possibility to gain knowledge without having to be physically present at the place of training and update their skills.[4] Another significant benefit of e-learning in nursing education is the strengthening of clinical competencies, which, in line with Feng and Liu studies, leads to encouraging nurses to continuously improve their clinical skills.[26,33] For example, virtual communication with patients and treatment teams can help students to communicate better and more effectively with their patients and colleagues in times of crisis, and by strengthening communication skills, get to know the real conditions of clinical departments.[57,60] In line with the results of the present study, learning improves students' cognitive skills by providing interactive educational content and various evaluation techniques. The results of other studies also show that this makes students better able to absorb information, record it in their minds and use it in the hospital.[9,27] Another important advantage in the current research is to improve educational processes and improve the quality of education in order to increase productivity and reduce the duration of education and skills for learners. In this regard, Najjar's study show that the integration of e-learning has allowed students to have more access to higher education because it frees them from the requirement of physical presence and has a significant positive effect on their academic flexibility.[61] The diversity and applicability of the content in electronic education in nursing is one of the other advantages of this educational method. In this regard, Ongor and Uslusoy showed that this educational method taking into account the cultural and linguistic differences, in a more attractive and diverse way, increases the possibility of the desire to learn and accompany the education process.[62]

In contrast to the advantages of electronic education,

Table 1. The opportunities or advantages of e-learning in nursing education

Parameters	Total percent	Impact rate	N (%)	Items	References
Accessibility and flexibility	26.7	68	7 (2.7)	Access to a wide range of international knowledge and information	14-20
			31 (12.2)	Easy accessibility	14-18,20-45
			4 (1.6)	Accessible to a larger audience	16,31,39,45
			26 (10.2)	Flexibility in terms of time and place	14,15,17-19,21-26,28,30,31,33-35,37,39,43,45-48
Efficiency and effectiveness	12.5	32	27 (10.6)	Cost-effectiveness	15,17-19,21-26,28,30-37,39,42-45,47,49,50
			5 (2.0)	Efficiency in time and cost	14,27,29,43,50
Strengthening clinical competencies	25.1	63	53 (20.8)	Development of professional and clinical skills	14,26,51-53
			3 (1.2)	Strengthen critical thinking	14,43,48
			2 (0.8)	Strengthen cognitive skills	14,48
			2 (0.8)	Personal and professional growth	14,48
			2 (0.8)	Development of communication skills	8,43
			1 (0.4)	Development of clinical competencies	54
			1 (0.4)	Self-efficacy in performing nursing skills	55
Features of electronic education	13.7	35	1 (0.4)	Completion of traditional education	14
			14 (5.5)	Self-directed learning	14,17,20,22,28,31,33,36-39,43,46,56
			18 (7.1)	Interactive and engaging learning experience	15,17,18,20-22,25,30,31,34,35,37-40,45,47,49
			2 (0.8)	Personal and spontaneous interaction between teacher and learner	22,31
Improving educational processes	5.5	14	2 (0.8)	Reduce training time	29,43
			1 (0.4)	Providing continuous training	31
			2 (0.8)	Educational support and variety in it	19,57
			1 (0.4)	Facilitate individual training programs	38
			2 (0.8)	Responding to individual learning needs	20,45
			1 (0.4)	Facilitate the learning process	41
			5 (2.0)	Independence in learning	14,28,31,40,58
Improving the quality of education	1.6	4	1 (0.4)	Achieving goals in the cognitive field	31
			1 (0.4)	Enhancing and encouraging learning in nursing education	54
			2 (0.8)	Bridging the gap between theory and practice	43,51
Evaluation and feedback	6.3	16	3 (1.2)	Evaluating and closely monitoring the progress and performance of students	26,30,59
			2 (0.8)	Provide quick and immediate feedback to students	15,51
			2 (0.8)	Use of online assessment and test tools	19,57
			1 (0.4)	Self-assessment by the learner	37,57
			1 (0.4)	Providing detailed statistics and reports about student performance	19
			7 (2.7)	Student satisfaction	29,32,40,55,56,58,59
Diversity and practicality of content	4.7	12	1 (0.4)	Access to various multimedia content	18
			1 (0.4)	Improve content and format	46
			1 (0.4)	Attractive content	46
			1 (0.4)	Communicate with content	46
			1 (0.4)	Utilization of content learning	46
			1 (0.4)	Standardized content	35
			1 (0.4)	Integrating nursing information and information into the curriculum	21
			1 (0.4)	Content focus on practical and communication skills in real situations	26
			1 (0.4)	The possibility of providing practical lessons virtually	37,39,57
			1 (0.4)	Providing up-to-date and new content with fast update capability	18,21
			2 (0.8)	Publish and share content with greater speed and breadth	22,27
Setting learning environment	2.0	5	2 (0.8)	Information-based, interactive and constructivist learning environment	18,31
			1 (0.4)	Providing virtual reality conditions for training in job-related fields	26
			1 (0.4)	Creating a challenging learning environment	52
			1 (0.4)	Reduce noise pollution	58
Promotion of nursing professors' role	2.0	5	1 (0.4)	Personal and professional growth of professors	14
			2 (0.8)	Promoting communication and cooperation between nursing professors	23,27
			1 (0.4)	Promoting the leadership role of nursing professors	32
			1 (0.4)	Improving the role of the developer and supporting the teacher	22

Table 2. The challenges or disadvantages of e-learning in nursing education

Parameters	Total percent	Impact rate	N (%)	Items	References
Challenges of evaluation and feedback	8.2	18	5 (2.3)	Failure to evaluate and control the quality of courses	20,21,31,38,46
			2 (0.9)	Uncertainty of maintenance and preservation of acquired clinical knowledge and skills	38,44
			2 (0.9)	Absence of course evaluation tools and online content	38,44
			9 (4.1)	Limited opportunities for immediate feedback and clarification of doubts	16-18,22,28,34,38,51,58
Problems related to human resource development	11.8	26	2 (0.9)	Lack of personnel training in the development of online training courses	38,44
			2 (0.9)	Insufficient human resources	18,27
			6 (2.7)	Failure to strengthen information technology skills	20,21,27,35,38,44
			3 (1.4)	Not enough time	28,31,38
			5 (2.3)	lack of motivation	15,20,25,30,38
			2 (0.9)	Lack of familiarity with standards in design and implementation	21,38
			3 (1.4)	Lack of skills to design courses electronically	21,26,38
			3 (1.4)	Teachers' resistance	21,31,38
Structural and technical limitation	19.1	42	3 (1.4)	Structural limitations of the course such as time and implementation method	21,38,46
			8 (3.6)	The relative low level of computer literacy of people	15,18,21,27,31,42,45,50
			4 (1.8)	Limits of access to the global Internet	18,35,38,48
			20 (9.1)	Technical problems related to hardware and software	17-20,24-28,31,34,35,39,42,43,45,48,51,55,58
			2 (0.9)	Lack of technical support from institutions.	18,50
			2 (0.9)	Lack of knowledge about working with tools	14, 38
			3 (1.4)	Potential for distraction secondary to frequent disconnection and connection	15,20,30
Challenges related to communication and interaction	26.8	59	30 (13.6)	Lack of face-to-face interaction	15,17-20,22-28,30-36,39,42-45,49,51,54,55,58
			19 (8.6)	Decreased social interactions and lack of socialization	15-17,19,22,24-26,28,30-32,34,39,42,43,45,54
			6 (2.7)	Limited interaction and communication between students and lecturers	18,28,31,35,48,58
			4 (1.8)	Lack of continuous and correct communication between experts in the three fields of information technology and educational technology and nursing	18,38,44,46
Challenges related to the content of education	9.1	20	4 (1.8)	Incompatibility of content with reality and needs and goals	18,38,44,46
			4 (1.8)	Imbalance in information about e-learning in the world	14,38,44
			3 (1.4)	The possibility of breaking the necessary educational order	18,38,44
			3 (1.4)	Absence of drawing legal boundaries and educational regulations	18,38,44
			3 (1.4)	Lack of defined goals for training	18,38,44
			3 (1.4)	Lack of management roadmap and educational law and regulations	18,38,44
Financial challenges	4.1	9	3 (1.4)	The cost of developing an e-learning program	20,38,50
			3 (1.4)	Hardware and software cost	20,38,50
			3 (1.4)	The cost of global Internet access	20,38,50
Organizational challenges	1.8	4	2 (0.9)	Limits of institutional readiness in human resources and infrastructure	18,38
			2 (0.9)	Absence of an organ as the guardian of e-learning in organizations	18,50
Cultural challenges	8.2	18	3 (1.4)	Lack of culture in use	18,38,44
			3 (1.4)	No change in traditional attitudes	18,38,44
			3 (1.4)	The existence of negative and pessimistic cultural attitudes towards the Internet	18,38,44
			3 (1.4)	Absence of culturally and socially defined content security supervisor	18,38,44
			3 (1.4)	Rejection	18,38,44
			3 (1.4)	Fear of the disappearance of the role of the teacher	18,38,44
Challenges of professional competence	7.3	16	3 (1.4)	Limits of understanding concepts	18,38,44
			3 (1.4)	Short response time	18,38,44
			2 (0.9)	Uncertainty of achieving goals in the emotional and psychomotor field	31,38
			5 (2.3)	Limited opportunities to learn and develop practical skills	15,26,30,31,55
			3 (1.4)	Inability to influence professional performance	18,38,44
Challenges of ethics and information security	3.6	8	3 (1.4)	The field of moral conflicts	18,38,44
			3 (1.4)	Security of personal information	18,38,44
			2 (0.9)	Political issues	44,52

Table 3. The required components of e-learning in nursing education

Parameters	Total percent	Impact rate	N (%)	Items	References
Technology infrastructure	22.75	38	23 (13.77)	Upgrading telecommunication systems and internet network	16-18,23-26,28,32,33,36,38,42,44-48,51,53-55,58
			9 (5.39)	Connecting educational systems to the Internet	18,20,28,38,40,43,53-55
			6 (3.59)	Embedding technical tools and defining process engineering	18,19,27,39,53,55
Human infrastructure	13.77	23	8 (4.79)	Increasing cooperation between the main players of the virtual education system	21,25,27,35,39,40,45,46
			3 (1.8)	Improving information literacy and working skills with computers and software	27,40,53
			10 (5.99)	Changing the individual mindsets of the agents involved	18,26-28,31,36,38,40,53,54
			2 (1.2)	Reconstruction of roles and relationships	18,53
Pedagogical infrastructure	11.98	20	2 (1.2)	Moving from teacher-centered to student-centered	18,53
			4 (2.4)	Determining the goals of e-learning projects	18,34,40,53
			9 (5.39)	Compilation of innovative educational resources and evaluation	14,20,22,27,31,38,40,45,53
			5 (2.99)	Research to choose the best platform	26,27,40,47,53
Cultural and social infrastructure	16.17	27	9 (5.39)	Spreading the culture of netocracy	14,17,18,26,33,39,43,44,53
			2 (1.2)	Cultivating a global citizen by preserving indigenous and national values	18,53
			2 (1.2)	Trying to distribute learning and education fairly	18,53
			14 (8.38)	The spread of new pedagogical culture - independence in learning	17,18,26,31,34,36,42,44,45,49,53,58
Cultural and social infrastructure	3.59	6	2 (1.2)	Planning for generating income from electronic education	18,53
			2 (1.2)	Investment in e-learning	18,53
			2 (1.2)	Report the costs associated with any type of training in the long term	18,53
Management and leadership infrastructure	31.74	53	7 (4.19)	Formulation of policies, guidelines and executive laws of e-learning	18-20,38,40,47,53
			2 (1.2)	International and global approach to education	18,53
			2 (1.2)	Issuing licenses for intellectual property issues	18,53
			3 (1.8)	Quality assurance standards, authenticity and credibility	40,53,56
			28 (16.77)	Use of a recognized learning management system or platform	15-17,19,23-26,30-36,39,42-45,47,49,51,53-55,58
			4 (2.4)	Recruitment of academic staff	18,40,47,53
			7 (4.19)	Official support of the organization	19,21,40,43,53,55,58

disadvantages are also mentioned in this study, which are usually caused by the reduction of face-to-face interaction between students and lecturers. This reduction of interaction may lead to a decrease in interactive opportunities, a feeling of lack of support and guidance, a feeling of isolation and a decrease in educational motivation in students. The reduction of interaction in other studies has also been expressed as an obstacle in education, and social interactions in regular face-to-face education such as classes, research groups, and workshops are far more than in electronic education.[63,64] Another challenge obtained from this study was structural limitations and insufficient technical support. In this regard, Macdonald states that these limitations can lead to a lack of flexibility in the time and content of education and ultimately cause students uncertainty in using educational tools.[57] In other words, the contradiction in the results of the advantages or disadvantages of e-learning is derived from the technical infrastructure and equipment that usually manifests itself in low-income countries.

In the following, the various infrastructure components required for the implementation and development of electronic education in nursing are proposed in the present study, which is in line with the results of other studies.[23,24] The technological infrastructure includes the upgrading of telecommunication systems and the Internet network and the installation of technical and engineering tools that can be presented and managed through these modern technical tools, educational content and educational software.[65] Human infrastructures that by using these infrastructures, people make the best use of educational technologies and achieve a more motivating and engaging learning experience.[66] Pedagogical infrastructure can help improve the quality and experience of online learning by changing from teacher-centered to student-centered and students are encouraged to an autonomous and motivated learning process.[67] Cultural and social infrastructure leads to the fair distribution of educational opportunities and facilities by promoting positive values and concepts in the educational society.[18] Economic infrastructure facilitates and accelerates the development of education by using new technologies and the development of educational platforms and applications and leads to the formulation of policies, the use of an international approach, the issuance

**Table 4.** Characteristics of the studies included in the analysis

First author	Electronic training	Searched databases	The purpose of the study	Participants
Bloomfield et al[14] 2008	Using computer assisted learning	CINAHL, Medline, BNI, PsycInfo and ERIC	Assisted learning for clinical skills education in nursing, the ways in which it has been studied and the general findings.	Nursing students
Booth et al[46] 2009	Workplace-based e-learning	Emerald, ERIC, IBSS, Index to Theses, LISA, MEDLINE, PsycINFO and Social Science Citation Index.	To address the question: Which Workplace-based e-learning (WBEL) techniques are most effective in enhancing the student learning experience?	Nurses, doctors, librarians and health information students
Button et al[21] 2014	E-learning & information communication technology (ICT)	CINAHL, MEDLINE, OVID, the ProQuest Central, PubMed, ERIC	To identify research related To E-learning and associated technologies in preregistration nursing programs and to identify issues for both students and educators who are using E-learning.	Nursing students and/or nurse educators
Carroll et al[22] 2009	On-line learning	British Education Index, CINAHL, Emerald, ERIC, IBSS, LISA, MEDLINE, PsycINFO, and Social Science	To explore UK health-care professionals' experience of on-line learning techniques	Nurses, midwives, and allied professions, general practitioners and hospital doctors
Cook et al[23] 2010-1	Web-based learning	MEDLINE, EMBASE, ERIC, CINAHL and other databases	To describe the variation in configurations, instructional methods and presentation formats in WBL	Doctors, nurses, training nurses, dentists in training, dentists, pharmacists in training.
Cook et al[24] 2010-2	Internet-based instruction	MEDLINE, CINAHL, EMBASE, and ERIC	To investigate time and learning efficiency in Internet-based learning	Physicians, nurses, pharmacists, dentists, veterinarians, and physical therapists
Cook et al[25] 2010-3	Internet-based learning	MEDLINE, CINAHL, EMBASE, Web of Science, Scopus, ERIC, TimeLit, Dissertation Abstracts, and the University of Toronto Research	Two Investigate how to improve Inquiry-based learning (IBL) is needed.	Physicians, nurses, pharmacists, dentists, veterinarians, and physical therapists
Cook et al[51] 2008	Internet-based learning	MEDLINE, Scopus, CINAHL, EMBASE, ERIC, TimeLit, Web of Science, Dissertation Abstracts, and the University of Toronto Research	To summarize the effect of Internet-based instruction for health professions learners compared with no intervention and with non-Internet interventions.	Student physicians, nurses, pharmacists, dentists, and other health care professionals
Du et al[55] 2013	Web-based distance learning	PubMed and Embase	To examine the efficacy of the web-based distance education for nursing students and employed nurses.	Nursing students and employed nurses
Du et al[8] 2022	Blended learning	PubMed and Embase, Web of Science, CINAHL and the Cochrane library	To determine the effectiveness of blended learning versus traditional face-to-face teaching in nursing education from the three aspects of knowledge, skills and satisfaction	Nursing students
Feng et al[26] 2013	E-Learning	PubMed, Medline, CINAHL, ERIC, and Cochrane Library	To determine the effectiveness of situated e-learning in prelicensure and postlicensure medical and nursing education.	Nursing students and employed nurses, medical student
Frehywot et al[27] 2013	E-learning	PubMed	Summarizes the literature on e-learning in low and middle-income countries (LMIC), and presents the spectrum of tools and strategies used.	Health professionals
Graafland et al[52] 2012	Games for training	PubMed, Embase, the Cochrane Database of Systematic Reviews, PsycINFO and CINAHL	To review current serious games for training medical professionals and to evaluate the validity testing of such games.	Doctors, nurses, physiotherapists, paramedics
Hansen[28] 2008	3-D Healthcare Learning	YouTube, and social networks, such as Facebook, Twitter	To convey knowledge and ideas that have been established concerning the use of 3-D virtual worlds in medical and health professional education to date whilst describing, summarizing, evaluating, and clarifying the current literature.	Medicine professionals
Hosseini et al[29] 2016	E-Learning	Science Direct, PubMed, SID	to evaluate the benefits of e-Learning in the Nursing Education.	Nursing students
Leijon et al[15] 2022	E-Learning	MEDLINE, CINAHL, OVID, and PubMed	Gamification and e-learning for young learners: A systematic literature review, bibliometric analysis, and future research agenda.	Undergraduate nursing students
Khatib Zanjani et al[53] 2012	E-Learning	ERIC, ACM, Digital Learning, OECDT	The structured analysis of requirements, challenges, problems, and barriers in the application of e-learning in education and thus provide a model and guide for choosing, designing, and implementing an electronic course.	Medical Sciences students
Kleinpell et al[30] 2011	Web-based	OVID-MEDLINE, PubMed, and CINAHL	To identify, catalog, and critically evaluate Web-based resources for critical care education.	Nurses
Klimova[16] 2018	E-Learning	Web of Science, ScienceDirect, Scopus, and MEDLINE	two Use of eLearning in Medical Education and Healthcare Practice	Medical students, doctors, nurses, or other healthcare
Koch[31] 2014	E-Learning	Web of Science, ScienceDirect, Scopus,	to answer the following question: How does e-learning transform the role of nurse educators?	Nursing educators

Table 4. Continued.

First author	Electronic training	Searched databases	The purpose of the study	Participants
Kokol et al [47] 2006	E-Learning	Web of Science, ScienceDirect, Scopus,	Investigating the E-learning challenges faced by students during COVID-19 in Namibia.	Nursing Education students
Kuriplachova et al [48] 2021	E-Learning	PubMed, Medline	Moodle implementation for e-learning: A systematic review.	Nursing and healthcare students
Lahti et al [32] 2014	E-Learning	MEDLINE CINAHL PsycINFO and ERIC	To assess the impact of e-learning on nurses' and nursing student's knowledge, skills and satisfaction.	Nurses and student nurses
Lam-Antoniades et al [49] 2009	Electronic continuing education	MEDLINE, EMBASE, and CINAHL	Two provides an update on evidence from randomized controlled trials (RCTs) assessing the effectiveness of e-CE in the health professions.	Physicians, nurses, nursing aides, pharmacists, paramedics, and nursing home managers.
Lee [54] 2015	E-Learning		Using e-learning to enhance nurse education	Nurse education
Liu et al [33] 2016	Blended learning	Medline, CINAHL, ScienceDirect, Ovid Embase, Web of Science, and ERIC	To assess the effectiveness of blended learning for health professional learners compared with no intervention and with nonblended learning	Health professional learners
Mancuso et al [34] 2009	Distance education	PubMed, CINAHL, ERIC, and Health Sciences in ProQuest	What are nursing faculty members' perceptions of distance education in nursing?	Nursing faculty members
Martinengo et al [35] 2019	Digital education	CENTRAL) (Cochrane Library), MEDLINE (Ovid), Embase (Ovid), Web of Science, the Educational Resource Information Centre (ERIC) (Ovid), PsycINFO (Ovid), the Cumulative Index to Nursing and Allied Health Literature (CINAHL) (EBSCO), the ProQuest Dissertation and Theses database, and trial registries.	To assess the effectiveness of digital education as a stand-alone approach or as part of a blended-learning approach in improving pre- and post-registration health care professionals' knowledge, attitudes, practical skills, and behavior in the management of chronic wounds, as well as their satisfaction with the intervention. Secondary objectives are to evaluate patient-related outcomes, cost-effectiveness of the interventions, and any unfavorable or undesirable outcomes that may arise.	Health care professionals
Matava et al [36] 2017	Mobile apps	App Store, Google Play, BlackBerry World, and Windows Store	To critically evaluate the quality of airway management apps and target revised Bloom's Taxonomy cognitive levels.	Emergency medical technicians, health care professionals, paramedics trainees nurses, anesthesiologists, emergency physicians critical care physicians, military medics, medical students, family medicine physicians, lifeguards firefighters, respiratory therapists
McCutcheon et al [37] 2015	Blended learning	MEDLINE, CINAHL, BREI, ERIC and AUEI	To determine whether the use of an online or blended learning paradigm has the potential to enhance the teaching of clinical skills in undergraduate nursing.	undergraduate nurse
McDonald et al [12] 2018	E-learning	MEDLINE, CINAHL, Cochrane Library and ProQuest Nursing and Allied Health Source	To Examine the current evidence on the effectiveness of digital technologies or e-based learning for enhancing the skills and knowledge of nursing students in nursing assessment.	Nursing students
Meinert et al [50] 2021	E-Learning	PubMed, Scopus, Education Resource Information Centre (ERIC), Web of Science, Embase, Global Health, Health Management Information Consortium (HMIC), Prospero, and OVID.	To explore the state of evidence concerning cost capture within eLearning in health professions education.	Health professions students
Mousazadeh et al [58] 2016	E-Learning	Medline and CINAHL databases and Google	To evaluate the effectiveness of e learning in learning.	Medical and non-medical students
Naderifar et al [38] 2016	E-Learning	Medline, Ovid, ProQuest, and PubMed	Challenge based learning in higher education–A systematic literature review.	Medical students
Nakhoda et al [39] 2021	E-Learning	PubMed, Scopus, Elsevier, Google Scholar, Web of Science and Iranian Scientific Information Database (SID), IranDoc, Civilica and Magiran	To assess E-Learning Satisfaction (ELS) in medical and non-medical students during COVID-19 pandemic.	Medical and non-medical students
Patterson et al [40] 2012	Distance learning	CINAHL, Academic Search Premier, Educational Resource Information Centre, Health Source, Educational Research Complete, Computers and Applied Sciences Complete, and ProQuest Dissertation Abstracts. The search engine Google Scholar was also used	To describe the state of the qualitative and quantitative nursing research on student outcomes of distance learning.	Nursing students

Table 4. Continued.

First author	Electronic training	Searched databases	The purpose of the study	Participants
Peng et al[17] 2017	Internet-based learning	Medline, Web of Science, ProQuest, Google scholar, ERIC and Elsevier	To explore the impact of Internet-based learning on students/professionals' knowledge of public health compared with no intervention and with traditional face-to-face (FTF) formats.	Medical students, professionals of public health
Petty[56] 2013	E-Learning	CINAHL (Cumulative Index of Nursing and Allied Health Literature) with full text (EBSCO) and MEDLINE via the NHS Evidence Healthcare database	To identify literature that explores the effectiveness of interactive, TE tools on knowledge acquisition and learner satisfaction within healthcare with a view to evaluating their use for post-basic nurse education.	Healthcare professionals
Rahimi et al[18] 2013	E-Learning	PubMed- Embase, Magiran, Medline-Cochrane -Eric, SID - Iranmedex	E-learning, barriers to implementation, solutions	Medical science students
Regmi & Jones[41] 2021	E-Learning	MEDLINE, EMBASE, Allied & Complementary Medicine, DH-DATA, PsycINFO, CINAHL, Global Health, BREI (British Education Index), AEI (Australian Education Index), Web of Science, CENTRAL, ERIC and Google Scholar	To measure the impact of e-learning as compared to traditional face-to-face learning, both measured and perceived, on health sciences education	Doctors, nurses and allied health professionals)
Richardson et al[59] 2017	Learning in the online environment	EBSCO, PsycINFO, ERIC	To investigate Satisfaction and Learning in the Online Environment	Students from all science
River et al[42] 2016	Blending technology	Medline, CINAHL, ERIC and Embase	To identify how technology has been incorporated into TBL in higher education health disciplines	Nursing and other health science students
Rowe et al[43] 2012	Blended learning	CINAHL and MEDLINE	To determine the impact of blended learning in the clinical education of healthcare students.	Healthcare students
Sadeghi Mahali et al[44] 2022	Virtual education	PubMed, ScienceDirect, Scopus, Google Scholar, SID, IranDoc	Comparison of virtual education challenges in nursing before and after COVID-19	Nursing education students
Vallée et al[19] 2020	Blended learning	MEDLINE	To assess the effectiveness of blended learning compared to that of traditional learning in health education.	Nursing, pharmacy, physiotherapy, dentistry students
Wilkinson et al[45] 2009	E-Learning	BNI, Medline, ERIC, BEI, AEI Web of Knowledge (ISI), PsycINFO	Describe and discuss the psychometric properties of instruments used in healthcare education settings measuring experience and attitudes of healthcare students' regarding their ICT skills and their use of computers and the Internet for education	Students in the healthcare professions
Wolbrink & Burns[20] 2012	Internet-based learning	MEDLINE/PubMed	To Define the key concepts of Internet-based learning, summarize the current literature, and describe how Internet-based learning may be uniquely suited for the critical care provider	Medical students
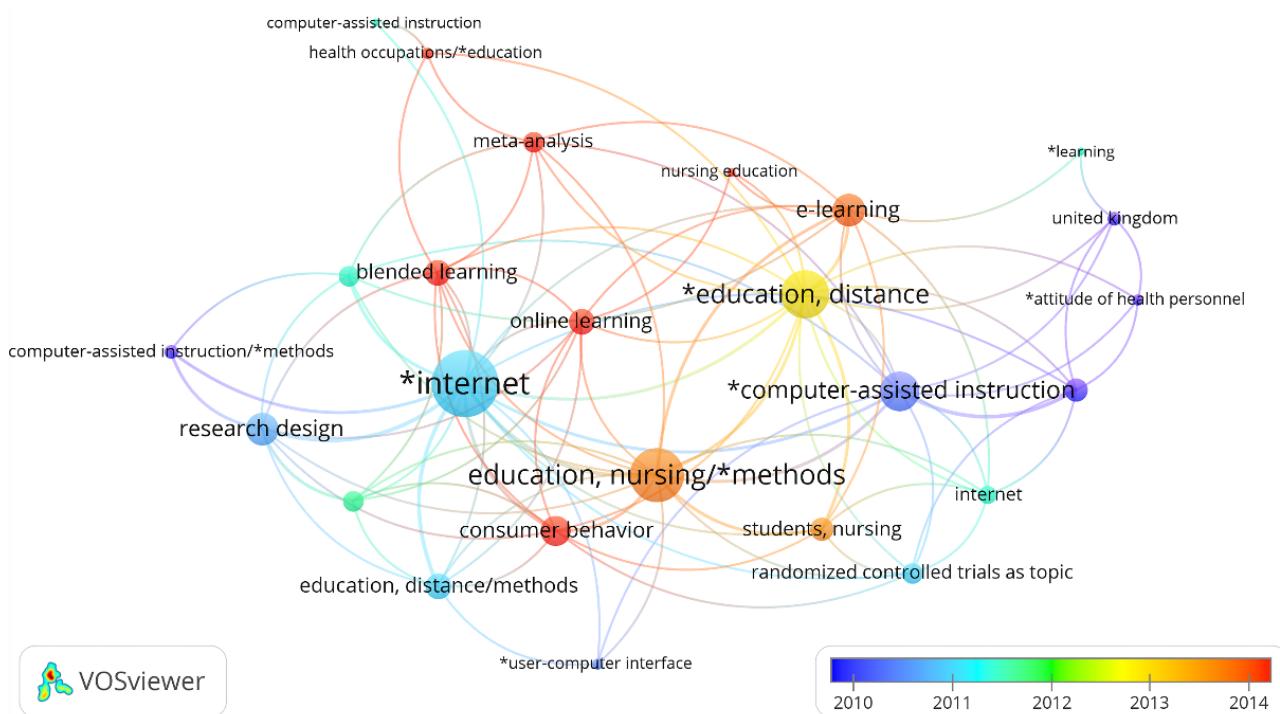
**Figure 2.** The variety of keywords of selected studies
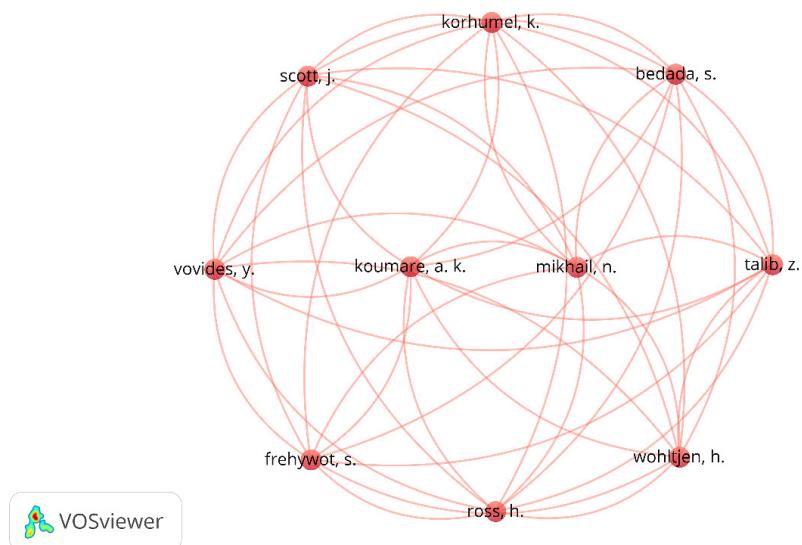
**Figure 3.** The combination of authors of selected studies
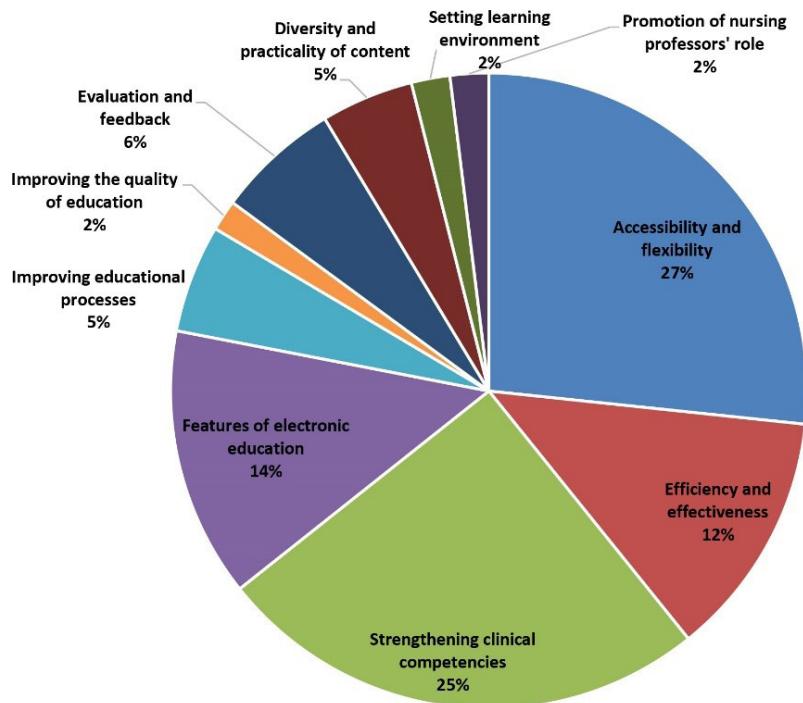
Figure 4. The opportunities or advantages of e-learning in nursing education

of intellectual property licenses, the determination of quality standards, the use of the learning management system attracts people.[53] Finally, facilitating the creation of effective and efficient infrastructures resulting from the present study will improve the online learning experience and the quality of e-learning. In this regard, the experience of many countries in the COVID-19 pandemic for the rapid and timely creation of technical infrastructure and equipment has shown the increase in the skill of the medical group providing care.[68]

One of the strengths of this study is the broad and extensive search in the databases, which has led to the comprehensiveness of the results. One of the limitations

of this study is the impossibility of categorizing studies according to low-income and high-income countries, as well as examining the results of electronic nursing education in the development of quality care skills.

Conclusion

This research found Opportunities and threats of E-learning and factors that influenced choosing it according to advantages and disadvantages. This research provides knowledge about criteria that can be used further in E-learning to benefit from its advantages depending on the infrastructure of different settings. The results of the present study indicate that the benefits of e-learning for
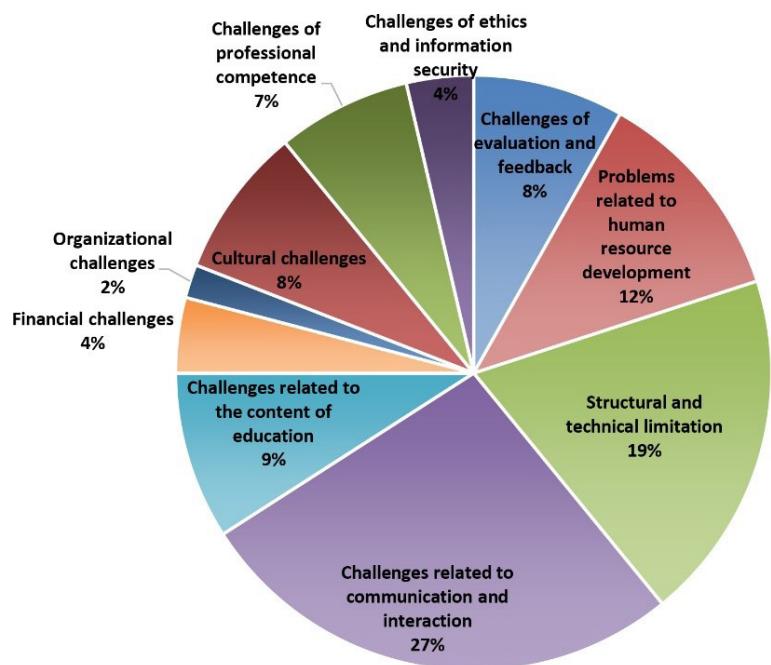
Figure 5. The challenges or disadvantages of e-learning in nursing education
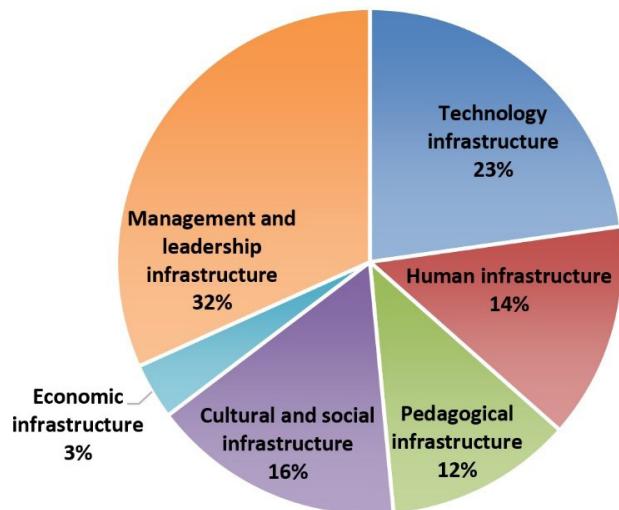
Figure 6. The required components of e-learning in nursing education

training nurses can be an efficient and effective method, so with the growing progress of science and technology, this method cannot be ignored, but it should overcome obstacles and challenges. In this way, by modifying the infrastructure, it is possible to reduce the disadvantages and add to its advantages.

Authors' Contribution
Conceptualization: Mahdieh Arian, Seyyed Reza Mazlom, Sedigheh Abdollahpour.
Data curation: Nazila Zarghi, Mohammad Bagher Oghazian, Sedigheh Abdollahpour.

Research Highlights

What is the current knowledge?
- E-learning is increasingly replacing traditional methods in medical science education. The future likely lies in blended learning, which combines the strengths of both approaches for a more engaging, effective, and accessible learning experience.

What is new here?
- Electronic education in nursing offers opportunities categorized into 10 areas: accessibility and flexibility, efficiency and effectiveness, strengthening clinical competencies, features of electronic education, improving educational processes, improving the quality of education, evaluation and feedback, diversity and practically of content, setting learning environment and promotion of nursing professors' role.
- Electronic education challenges, categorized into 10 groups: challenges of evaluation and feedback, problems related to the of human resources development, structural and technical limitations, challenges related to communication and interaction, challenges related to the content of education, financial challenges, organizational challenges, cultural challenges, challenges of professional competence, challenges of ethics and information security.
- The essential components for effective electronic teaching in nursing education are organized into 6 categories: technological infrastructure, human infrastructure, pedagogical infrastructure, cultural and social infrastructure, economic infrastructure, and management and leadership infrastructure.

Formal analysis: Mahdieh Arian, Sedigheh Abdollahpour.
Funding acquisition: Mahdieh Arian, Nazila Zarghi.
Investigation: Mahdieh Arian, Mohammad Bagher Oghazian.
Methodology: Mahdieh Arian, Sedigheh Abdollahpour.
Project administration: Mahdieh Arian.
Resources: Sedigheh Abdollahpour, Mahdieh Arian.
Software: Sedigheh Abdollahpour, Mahdieh Arian.
Supervision: Sedigheh Abdollahpour, Mahdieh Arian.
Validation: Mahdieh Arian, Seyyed Reza Mazlom, Sedigheh Abdollahpour.
Visualization: Sedigheh Abdollahpour, Mahdieh Arian.
Writing–original draft: Sedigheh Abdollahpour, Mahdieh Arian.
Writing–review & editing: Sedigheh Abdollahpour, Mahdieh Arian.

References
1. World Bank. World Bank Education COVID-19 School Closures Map. 2020. Available from: https://www.worldbank.org/en/data/interactive/2020/03/24/world-bank-education-and-covid-19. Accessed June 15, 2020.
2. Djeki E, Dégila J, Bondiombouy C, Alhassan MH. E-learning bibliometric analysis from 2015 to 2020. J Comput Educ. 2022; 9(4): 727-54. doi: 10.1007/s40692-021-00218-4
3. Rahayu NW, Ferdiana R, Kusumawardani SS. A systematic review of ontology use in e-learning recommender system. Comput Educ Artif Intell. 2022; 3: 100047. doi: 10.1016/j.caeai.2022.100047
4. Naciri A, Radid M, Kharbach A, Chemsi G. E-learning in health professions education during the COVID-19 pandemic: a systematic review. J Educ Eval Health Prof. 2021; 18: 27. doi: 10.3352/jeehp.2021.18.27
5. Vaona A, Banzi R, Kwag KH, Rigon G, Cereda D, Pecoraro V, et al. E-learning for health professionals. Cochrane Database Syst Rev. 2018; 1(1): CD011736. doi: 10.1002/14651858.CD011736.pub2
6. Pourghaznein T, Sabeghi H, Shariatinejad K. Effects of e-learning, lectures, and role playing on nursing students' knowledge acquisition, retention and satisfaction. Med J Islam Repub Iran. 2015;29:162.
7. Arian M, Nobahar M, Raiesdana N, Oghazian MB. Identifying the fields of activity, challenges and positive outcomes of nursing prescription: a systematic review. Hayat. 2018; 24(3): 279-95. [Persian].
8. Du L, Zhao L, Xu T, Wang Y, Zu W, Huang X, et al. Blended learning vs traditional teaching: the potential of a novel teaching strategy in nursing education - a systematic review and meta-analysis. Nurse Educ Pract. 2022; 63: 103354. doi: 10.1016/j.nepr.2022.103354
9. Voutilainen A, Saaranen T, Sormunen M. Conventional vs. e-learning in nursing education: a systematic review and meta-analysis. Nurse Educ Today. 2017; 50: 97-103. doi: 10.1016/j.nedt.2016.12.020
10. Divya KY, Binil V. E-learning challenges in nursing education during COVID-19 pandemic–a narrative review. Indian J Forensic Med Toxicol. 2021; 15(2): 2317-22. doi: 10.37506/ijfmt.v15i2.14718
11. Tabatabaei SH, Mirzaiean A, Keshmiri F. Opportunities and threats of e-learning in dental education in viewpoints of faculty members: a mixed method study. Dent Res J (Isfahan). 2022; 19: 89.
12. MacDonald CJ, Backhaus I, Vanezi E, Yeratziotis A, Clendinneng D, Seriola L, et al. European Union Digital Education quality standard framework and companion evaluation toolkit. Open Learn. 2024; 39(1): 85-100. doi: 10.1080/02680513.2021.1936476
13. Shea BJ, Grimshaw JM, Wells GA, Boers M, Andersson N, Hamel C, et al. Development of AMSTAR: a measurement tool to assess the methodological quality of systematic reviews. BMC Med Res Methodol. 2007; 7: 10. doi: 10.1186/1471-2288-7-10
14. Bloomfield JG, While AE, Roberts JD. Using computer assisted learning for clinical skills education in nursing: integrative review. J Adv Nurs. 2008; 63(3): 222-35. doi: 10.1111/j.1365-2648.2008.04653.x
15. Leijon M, Gudmundsson P, Staaf P, Christersson C. Challenge based learning in higher education–a systematic literature review. Innov Educ Teach Int. 2022; 59(5): 609-18. doi: 10.1080/14703297.2021.1892503
16. Klimova B. The use of e-learning in medical education and healthcare practice–a review study. In: Auer M, Zutin D, eds. Online Engineering & Internet of Things. Vol 22. Cham: Springer; 2018. p. 933-9. doi: 10.1007/978-3-319-64352-6_87
17. Peng Y, Yan W. Effect of Internet-Based Learning in Public Health Training: An Exploratory Meta-Analysis. International Conference e-Learning; 2017.
18. Rahimi B, Jebraeily M, Mehdi Oghli R, Rashidi A, Masomi R. The barriers of e-learning implementation in medical sciences domain and provided the necessary solutions. J Urmia Nurs Midwifery Fac. 2013; 11(6): 461-7. [Persian].
19. Vallée A, Blacher J, Cariou A, Sorbets E. Blended learning compared to traditional learning in medical education: systematic review and meta-analysis. J Med Internet Res. 2020; 22(8): e16504. doi: 10.2196/16504
20. Wolbrink TA, Burns JP. Internet-based learning and applications for critical care medicine. J Intensive Care Med. 2012; 27(5): 322-32. doi: 10.1177/0885066611429539
21. Button D, Harrington A, Belan I. E-learning & information communication technology (ICT) in nursing education: a review of the literature. Nurse Educ Today. 2014; 34(10): 1311-23. doi: 10.1016/j.nedt.2013.05.002
22. Carroll C, Booth A, Papaioannou D, Sutton A, Wong R. UK health-care professionals' experience of on-line learning techniques: a systematic review of qualitative data. J Contin Educ Health Prof. 2009; 29(4): 235-41. doi: 10.1002/chp.20041
23. Cook DA, Garside S, Levinson AJ, Dupras DM, Montori VM. What do we mean by web-based learning? a systematic review of the variability of interventions. Med Educ. 2010; 44(8): 765-74. doi: 10.1111/j.1365-2923.2010.03723.x
24. Cook DA, Levinson AJ, Garside S. Time and learning efficiency in internet-based learning: a systematic review and meta-analysis. Adv Health Sci Educ Theory Pract. 2010; 15(5): 755-70. doi: 10.1007/s10459-010-9231-x

25. Cook DA, Levinson AJ, Garside S, Dupras DM, Erwin PJ, Montori VM. Instructional design variations in internet-based learning for health professions education: a systematic review and meta-analysis. Acad Med. 2010; 85(5): 909-22. doi: 10.1097/ACM.0b013e3181d6c319

26. Feng JY, Chang YT, Chang HY, Erdley WS, Lin CH, Chang YJ. Systematic review of effectiveness of situated e-learning on medical and nursing education. Worldviews Evid Based Nurs. 2013; 10(3): 174-83. doi: 10.1111/wvn.12005

27. Frehywot S, Vovides Y, Talib Z, Mikhail N, Ross H, Wohltjen H, et al. E-learning in medical education in resource constrained low- and middle-income countries. Hum Resour Health. 2013; 11: 4. doi: 10.1186/1478-4491-11-4

28. Hansen MM. Versatile, immersive, creative and dynamic virtual 3-D healthcare learning environments: a review of the literature. J Med Internet Res. 2008; 10(3): e26. doi: 10.2196/jmir.1051

29. Hosseini MA, Ghahremani AR, Mohammadi Shahbolaghi F, Hamadzadeh S, Tamizi Z. The advantages of electronic learning in nursing education: a review study. J Nurs Educ. 2016; 4(4): 9-16. [Persian].

30. Kleinpell R, Ely EW, Williams G, Liolios A, Ward N, Tisherman SA. Web-based resources for critical care education. Crit Care Med. 2011; 39(3): 541-53. doi: 10.1097/CCM.0b013e318206b5b5

31. Koch LF. The nursing educator's role in e-learning: a literature review. Nurse Educ Today. 2014; 34(11): 1382-7. doi: 10.1016/j.nedt.2014.04.002

32. Lahti M, Hätönen H, Välimäki M. Impact of e-learning on nurses' and student nurses knowledge, skills, and satisfaction: a systematic review and meta-analysis. Int J Nurs Stud. 2014; 51(1): 136-49. doi: 10.1016/j.ijnurstu.2012.12.017

33. Liu Q, Peng W, Zhang F, Hu R, Li Y, Yan W. The effectiveness of blended learning in health professions: systematic review and meta-analysis. J Med Internet Res. 2016; 18(1): e2. doi: 10.2196/jmir.4807

34. Mancuso JM. Perceptions of distance education among nursing faculty members in North America. Nurs Health Sci. 2009; 11(2): 194-205. doi: 10.1111/j.1442-2018.2009.00456.x

35. Martinengo L, Yeo NJY, Tang ZQ, Markandran KD, Kyaw BM, Tudor Car L. Digital education for the management of chronic wounds in health care professionals: protocol for a systematic review by the digital health education collaboration. JMIR Res Protoc. 2019; 8(3): e12488. doi: 10.2196/12488

36. Matava C, Leo AM, Alam F. Mobile apps for teaching intubation: scoping review and critical analysis in e-learning. JMIR Med Educ. 2017; 3(2): e15. doi: 10.2196/mededu.7919

37. McCutcheon K, Lohan M, Traynor M, Martin D. A systematic review evaluating the impact of online or blended learning vs. face-to-face learning of clinical skills in undergraduate nurse education. J Adv Nurs. 2015; 71(2): 255-70. doi: 10.1111/jan.12509

38. Naderifar M, Ghaljaie F, Jalalodini A, Rezaie N, Salar A. Challenges of e-learning in medical sciences: a review article. J Med Educ Dev. 2016; 9(23): 102-11. [Persian].

39. Nakhoda K, Ahmady S, Gholami Fesharaki M, Gheshlaghi Azar N. COVID-19 pandemic and e-learning satisfaction in medical and non-medical student: a systematic review and meta-analysis. Iran J Public Health. 2021; 50(12): 2509-16. doi: 10.18502/ijph.v50i12.7933

40. Patterson BJ, Krouse AM, Roy L. Student outcomes of distance learning in nursing education: an integrative review. Comput Inform Nurs. 2012; 30(9): 475-88. doi: 10.1097/NXN.0b013e3182573ad4

41. Regmi K, Jones L. Effect of e-learning on health sciences education: a protocol for systematic review and meta-analysis. High Educ Pedagog. 2021; 6(1): 22-36. doi: 10.1080/23752696.2021.1883459

42. River J, Currie J, Crawford T, Betihavas V, Randall S. A systematic review examining the effectiveness of blending technology with team-based learning. Nurse Educ Today. 2016; 45: 185-92. doi: 10.1016/j.nedt.2016.08.012

43. Rowe M, Frantz J, Bozalek V. The role of blended learning in the clinical education of healthcare students: a systematic review. Med Teach. 2012; 34(4): e216-21. doi: 10.3109/0142159x.2012.642831

44. Sadeghi Mahali N, Arsalani N, Rad M, Nematifard T, Khaki S, Fallahi-Khoshknab M. Comparison of virtual education challenges in nursing before and after COVID-19; a systematic review. Iran J Syst Rev Med Sci. 2023; 1(3): 81-103.

45. Wilkinson A, While AE, Roberts J. Measurement of information and communication technology experience and attitudes to e-learning of students in the healthcare professions: integrative review. J Adv Nurs. 2009; 65(4): 755-72. doi: 10.1111/j.1365-2648.2008.04924.x

46. Booth A, Carroll C, Papaioannou D, Sutton A, Wong R. Applying findings from a systematic review of workplace-based e-learning: implications for health information professionals. Health Info Libr J. 2009; 26(1): 4-21. doi: 10.1111/j.1471-1842.2008.00834.x

47. Kokol P, Blazun H, Micetić-Turk D, Abbott PA. E-learning in nursing education--challenges and opportunities. Stud Health Technol Inform. 2006; 122: 387-90.

48. Kuriplachová G, Kováčková G, Magurová D, Kendrová L. Advantages and disadvantages of e-learning in nursing teaching process. J Health Syst Policies. 2019; 1(2): 45-54.

49. Lam-Antoniades M, Ratnapalan S, Tait G. Electronic continuing education in the health professions: an update on evidence from RCTs. J Contin Educ Health Prof. 2009; 29(1): 44-51. doi: 10.1002/chp.20005

50. Meinert E, Eerens J, Banks C, Maloney S, Rivers G, Ilic D, et al. Exploring the cost of e-learning in health professions education: scoping review. JMIR Med Educ. 2021; 7(1): e13681. doi: 10.2196/13681

51. Cook DA, Levinson AJ, Garside S, Dupras DM, Erwin PJ, Montori VM. Internet-based learning in the health professions: a meta-analysis. JAMA. 2008; 300(10): 1181-96. doi: 10.1001/jama.300.10.1181

52. Graafland M, Schraagen JM, Schijven MP. Systematic review of serious games for medical education and surgical skills training. Br J Surg. 2012; 99(10): 1322-30. doi: 10.1002/bjs.8819

53. Khatib Zanjani N, Zandi B, Farajollahi M, Sarmadi MR, Ebrahim Zadeh I. The structured analysis of requirements and challenges of e-learning and proposing a practical model for successful implementation of e-courses in medical sciences. Iran J Med Educ. 2012; 11(8): 995-1009. [Persian].

54. Lee P. Using e-learning to enhance nurse education. Nurs Times. 2015; 111(43): 18-9.

55. Du S, Liu Z, Liu S, Yin H, Xu G, Zhang H, et al. Web-based distance learning for nurse education: a systematic review. Int Nurs Rev. 2013; 60(2): 167-77. doi: 10.1111/inr.12015

56. Petty J. Interactive, technology-enhanced self-regulated learning tools in healthcare education: a literature review. Nurse Educ Today. 2013; 33(1): 53-9. doi: 10.1016/j.nedt.2012.06.008

57. McDonald EW, Boulton JL, Davis JL. E-learning and nursing assessment skills and knowledge - an integrative review. Nurse Educ Today. 2018; 66: 166-74. doi: 10.1016/j.nedt.2018.03.011

58. Mousazadeh S, Dehghani M, Mozaffari F, Ghasemnegad SM, Hakimi H, Bagherian S. The effectiveness of e-learning in learning: a review of the literature. Int J Med Res Health Sci. 2016; 5(2): 86-91.

59. Richardson JC, Maeda Y, Lv J, Caskurlu S. Social presence in relation to students' satisfaction and learning in the online environment: a meta-analysis. Comput Human Behav. 2017; 71: 402-17. doi: 10.1016/j.chb.2017.02.001

60. Can Ş, Durgun H, Dalcalı BK. Effect of online communication skills training on effective communication and self-efficacy and self-regulated learning skills of nursing students: a randomized controlled study. Nurse Educ Pract. 2022; 63: 103371. doi: 10.1016/j.nepr.2022.103371

61. Najjar N, Ajjaka L. E-learning: innovations and challenges in the new millennia. EuroMed Journal of Management. 2023; 5(1): 71-82. doi: 10.1504/emjm.2023.10052606

62. Ongor M, Uslusoy EC. The effect of multimedia-based education in e-learning on nursing students' academic success and motivation: a randomised controlled study. Nurse Educ Pract. 2023; 71: 103686. doi: 10.1016/j.nepr.2023.103686

63. Junco R, Elavsky CM, Heiberger G. Putting twitter to the test: assessing outcomes for student collaboration, engagement and success. Br J Educ Technol. 2013; 44(2): 273-87. doi: 10.1111/j.1467-8535.2012.01284.x

64. Means B, Toyama Y, Murphy R, Baki M. The effectiveness of online and blended learning: a meta-analysis of the empirical literature. Teach Coll Rec. 2013; 115(3): 1-47. doi: 10.1177/016146811311500307

65. Duderstadt JJ. New roles for the 21st-century university. Issues Sci Technol. 1999; 16(2): 37-44.

66. Farhan MK, Talib HA, Mohammed MS. Key factors for defining the conceptual framework for quality assurance in e-learning. J Inf Technol Manag. 2019; 11(3): 16-28. doi: 10.22059/jitm.2019.74292

67. Kebritchi M, Lipschuetz A, Santiague L. Issues and challenges for teaching successful online courses in higher education: a literature review. J Educ Technol Syst. 2017; 46(1): 4-29. doi: 10.1177/0047239516661713

68. Mirzakhani K, Jahani Shoorab N, Akbari A, Khadivzadeh T. High-risk pregnant women's experiences of the receiving prenatal care in COVID-19 pandemic: a qualitative study. BMC Pregnancy Childbirth. 2022; 22(1): 363. doi: 10.1186/s12884-022-04676-1