Nursing Section

Developing an E-learning Model for Nursing Education

SHAHIN RAOUFI[1], HOUMAN MANOOCHEHRI[2], NAHID ZARIFSANAIEY[3], MALAHAT NIKRAVANMOFRAD[4]

ABSTRACT

Introduction: Technology has revolutionised higher education and transformed traditional approaches to teaching and learning. However, application of e-learning in any discipline including nursing requires a model.

Aim: To develop an e-learning model for nursing education.

Materials and Methods: In this descriptive-analytical study, three stages were followed between June 2017 to December 2018. In the Stage one: review of literature and library search was used in databases of ERIC, PubMed, Science Direct, ProQuest, Scopus, and Google Scholar and Iranian databases of SID, Magiran and Iran Medex using to find available 65 models and their features. In the Stage two, semi-structured interviews with

26 experts in e-learning and quantitative content analysis of the interviews were used, and in the Stage three: The validity of the model was determined by with 12 experts in e-learning and Delphi method, and finally, the model was presented.

Results: Seven general components including education, infrastructure, support, culture, ethics/law, evaluation, and learner with 31 subcomponents were determined in stages one and two. They were then used in the development of the e-learning model which was validated by Delphi method.

Conclusion: The principles of pedagogy were used to develop this model in an understandable and simple manner. Therefore, it can be used in many disciplines.

Keywords: Distance education, Distance learning, Online education, Online learning

INTRODUCTION

Technology has revolutionised higher education and transformed traditional approaches to teaching and learning. In traditional methods, education is confined to classroom and physical presence of teachers and students in an educational setting [1]. In contrast, in technology-based methods such as Electronic Learning (e-learning), the focus is on students and their interactions with the classroom, teacher and educational setting through the internet [2]. In e-learning, information technology tools and systems are used online and offline and education can be web-based, computer-based, virtual-based, and digital-based [3].

The benefits of this method include widespread distribution, easy access, updated educational materials, personalised learning, education at any time and place, reduced expenses related to teachers' salary, classroom, commuting of students etc., direct interaction with contents by students [4-6], flexibility, cost-effectiveness and learners' interactions with one another [7]. Meeting the needs and expectations of learners [8]. Accordingly, its use in higher education has witnessed an ascending trend in recent decades [9] and many universities have been forced to utilise it in their teaching and learning process [10].

Nursing education is no exception to this rule and positive-effects of e-learning have been demonstrated in various studies. For example, in a systematic meta-analysis, Voutilainen A et al., showed that half of the studies have reported significant and positive-effects of e-learning on participants' knowledge and skills [11]. In a review study by McDonald EW et al., its effect on nurses' knowledge and assessment skills was rated positive on the subject of fundamentals of nursing as the score of experimental group score was higher in mid-term and final exams and the authors believe it is a reliable method for clinical education [12] and it increases students' confidence, self-awareness, as well as self-evaluation and reduces stress [13].

In 2001, e-learning was introduced to higher education of Iran [14]. However, evidence suggests that Iranian universities have been faced with challenges to apply it. For instance, it has not been defined in strategic plans, no framework or specific model exists for using this approach, faculty and students are not familiar with

its literature, no related infrastructure has set up and no appropriate budget is allocated for purchasing, setting up, and maintaining the hardware [14]. However, in recent years, universities have started a competition to include this approach in their programs. Therefore, in strategic plans of the Ministry of Health and Medical Education in 2015, development of e-learning in medical sciences was predicted in four operational axes, one of which was the establishment of an electronic university in medical sciences [15]. Hence, all affiliated universities including nursing colleges were asked to take measures for developing e-learning programs.

In fact, applying any educational method requires a valid guide or model to prevent flaws, i.e., a clear framework that covers all necessary dimensions of it. Models are subjective reflections of reality that are developed to describe, manifest and predict phenomena. They show facts in the form of words, symbols or arrows [16]. A model is usually developed based on experience and research and furnishes planners and executers with the opportunity to implement them holistically. The present study was conducted to develop an e-learning model as a guideline for designing, implementing and evaluating in baccalaureate nursing program. The present study aimed at developing an e-learning model for nursing education by literature review and interviews with experts.

MATERIALS AND METHODS

In this descriptive-analytical study, three stages were followed between June 2017 to December 2018. At stage one, with a theoretical review method, the features and components of an e-learning model were assessed with extensive review of literature. A search was carried out from 1990 to 2018 in English databases of ERIC, PubMed, Science Direct, ProQuest, Scopus, and Google Scholar, and Iranian databases of SID, Magiran, and Iran Medex using the following keywords: [e-learning model], [pattern models and e-learning] and [nursing]. The inclusion criteria were relevance to the design, development, features and components of an e-learning model. The exclusion criteria were being written in languages other than English and Persian and lack of access to full-text articles.

A total of 125 models were retrieved, of which, 65 highly-used ones in English and Persian were selected and reviewed in depth according to the study objectives. The results were saved in a set to be used in the second stage as a code pool. The codes were, then, assessed by the research team and classified in seven components: learner, infrastructure, support, education, ethics/law, culture and evaluation. Based on the components, 10 open-ended questions were designed for semi-structured interviews at the second stage. Face and content validities of these questions were confirmed by five e-learning experts.

At stage two, semi structured interviews with 26 experts and quantitative content analysis of their transcripts. Semi-structured interviews are used to determine persons' responses to a situation or phenomenon they have experienced. In this way, the question is already known, but since the answer is open, the interviewer can ask questions during the interview to complete the information [17]. Based on the components stage one, 10 open-ended questions were designed. The questions were about: Infrastructure, supportive, educational, legal/ethical, cultural, evaluation and learning resource in e-learning. The questions were asked from 26 experts in medical sciences, nursing, non-medical sciences, e-learning and information as well as communication technology. Purposive, criterion-based and snowball sampling methods were applied to choose the subjects. Then, they were invited on the phone or with email to participate in the study and those who agreed were interviewed in person or on the line with prior appointment. Each interview lasted 20-50 minutes, with mean duration of 35 minutes. All interviews were performed by one researcher and recorded with the permission of participants. The interviews were then transcribed and analysed with quantitative content approach, which is a systematic, purposive, and quantitative analysis of texts [18].

In this approach, an interview is transcribed and then counted in terms of specific keywords according to the questions. This means that some particular parts of the transcripts are considered as analysis units. These parts can include a text, a group of words, a phrase, a sentence or a paragraph. The frequency of these parts assumed to indicate the importance of them in the text is counted [19].

The words and statements of the interviews were extracted from the transcripts and a code pool was formed at the first stage. The codes were then gathered and classified to form the components and subcomponents and the criterion to set the classifications was their frequency. The process was separately carried out by two researchers to ensure reliability with 86% agreement.

Following is an example of the encoding and categorisation of a transcript [Table/Fig-1]:

Question: What should be considered in designing and implementing e-learning in nursing?

Answer: First you have to see the university that offers this service, how much does it provide you with infrastructure? Of course, the infrastructure debate is a very detailed one, depends on a series of issues, how many students does it want, what kind of Learning Management System (LMS) does it want. Because based on the number of students you buy your LMS.

Note: The underlined words and sentences have been taken as the interview codes.

Word/Sentence	Frequency (Number of repeats)	Domain
Infrastructure-LMS	4	Infrastructural
Students	2	Educational

[Table/Fig-1]: The encoding and categorization of the above interview.

At stage three, the previous results were used to develop the initial model which was subsequently sent to 16 experts with a questionnaire containing seven open-ended questions. After 2 rounds of Delphi method, 12 complete questionnaires were obtained. Delphi is a systematic approach to extract expert opinions on a topic and reaching group consensus through a series of surveys, Delphi's goal is to reach a consensus of experts [20]. The number of Delphi rounds can be 2 to 10 times, depending on the research questions and if a consensus of experts is reached two rounds are sufficient, Depending on the percentage of agreement, the percentage of agreement is between 51-100% [20]. The percentage of experts in present study was 86%, so the research ended in the second round. The initial model was modified according to the experts' suggestions and sent to them again. Upon receiving their responses, the final model was developed and presented as the e-learning model for nursing students.

RESULTS

Given the aim, a descriptive method was used to develop an e-learning model for undergraduate nursing students. Interviews were analysed with quantitative content analysis and the model was validated by Delphi method. The following results were obtained:

At the first stage, 65 highly used e-learning models were reviewed in depth. [Table/Fig-2] presents a sample of features of some models at this stage [2,21-28].

Sl No.	Model name	Features
1	Technology acceptance model (TAM)	External variables, perceived usefulness (PU), Perceived ease of use (PEOU), Attitude towards using (AT), Behavioral Intention to Use (I), Actual Use (U) [21]
2	E-learning quality evaluation model	Course Development, Learner Support, Technological Factors, Assessment [22]
3	Khan's e-learning model	8 factors: Educational, technical, user interface design, organisational, ethical, managerial, support and evaluation [23]
4	MacDonald's demanding model	3 user's demands: Content, method, and services [24]
5	Addie's reference model	Analysis, design, development, implementation, and evaluation [25]
6	Collaborative cloud model	Focus on user, infrastructure, duties, programs, access, flexibility [26]
7	Virtual teaching model	Teacher's characteristics [pedagogic, specialised, technical, and communication skills (Learner's characteristics) communication, meta-cognitive, teamwork, technical, and learning interest and motivational skills (Teaching-learning process characteristics) design, implementation, and evaluation [27]
8	Selim: Based on the learners' perceptions	Teacher's characteristics, learner's characteristics, technology, and support [2]
9	Virtual curriculum implementation pattern	Participation components, input components, evaluation, logic and infrastructure [28]
10	The conceptual framework	7 major themes, including individual characteristics, presentation practices, evaluation, infrastructure, content, media, and interaction [2]

[Table/Fig-2]: A sample of models and their features [2,21-28].

At the second stage, interviews were conducted with 26 e-learning experts, of whom, 13 (50%) were from non-medical universities, 10 (38.5%) from medical universities and 3 (11.5%) from companies providing e-learning services. The [Table/Fig-3] presents frequency (percentage) of the most important words and statements obtained from quantitative analysis of interviews in terms of seven components: learner, infrastructure, support, education, ethics/law, culture and evaluation.

The [Table/Fig-3] shows the highest frequency of words in education (52.2%) and the lowest in culture (4%).

At stage three, the initial model was developed based on the results of the first two stages. Since most words/sentences were

| No.	Components	Total words/sentences	Percentage of words/sentences
1	**Learner** Student, learner, audience, user, learner	350	7.6
2	**Infrastructure** Providing the necessary hardware and software infrastructure	640	13.9
3	**Support** Technical, educational, financial support, specialised team, human resources, empowerment of professors-personnel, students, and authorities	240	5.4
4	**Education** Learner's analysis, responsibility and background; teaching-learning methods; educational design based on modern techniques; user interface design; evaluation [(diagnostic, formative, and summative)]; electronic content; instructor; monitoring	3000	65.4
5	**Ethics-Law** Development of laws for electronic environment, development of ethical codes for electronic environment, intellectual property, professionalism in physical and virtual environment, control	140	3
6	**Culture** Acculturation of the society, professors, students, staff, clinical setting, creating beliefs and motivations	100	2.2
7	**Evaluation** Evaluation, evaluation of the content, professor, course, audience and system	115	2.5
	Total	**4585**	**100**

[Table/Fig-3]: Frequency and percentage of words and sentences related to components and their subcomponents.

related to education, it was located at the centre of the model, but this does not suggest its superiority over other components. Findings related to infrastructure were considered as the context of the model, and support was positioned in the lower part of it. The remaining components were arranged around the centre, and the following figure was designed by the research team [Table/Fig-4]. The model and a questionnaire with seven open-ended questions were e-mailed to 16 experts for their opinions and comments (Delphi round one), and after 2 rounds, 12 of them responded to the questionnaire.

The initial model was modified according to their suggestions in round one and returned to the experts (Delphi round two). Upon receiving their responses, suggested modifications were implemented and the final model was formed, and the following figure was designed by the research team [Table/Fig-5]. In this model, the components are arranged clockwise without a predetermined rule. Therefore, each component is introduced in an oval shape because oval has no specific starting point, which means that all components are mutually dependent and a change in one affects all the others [29]. The diagram denotes flexibility and relativity of order among the seven components.
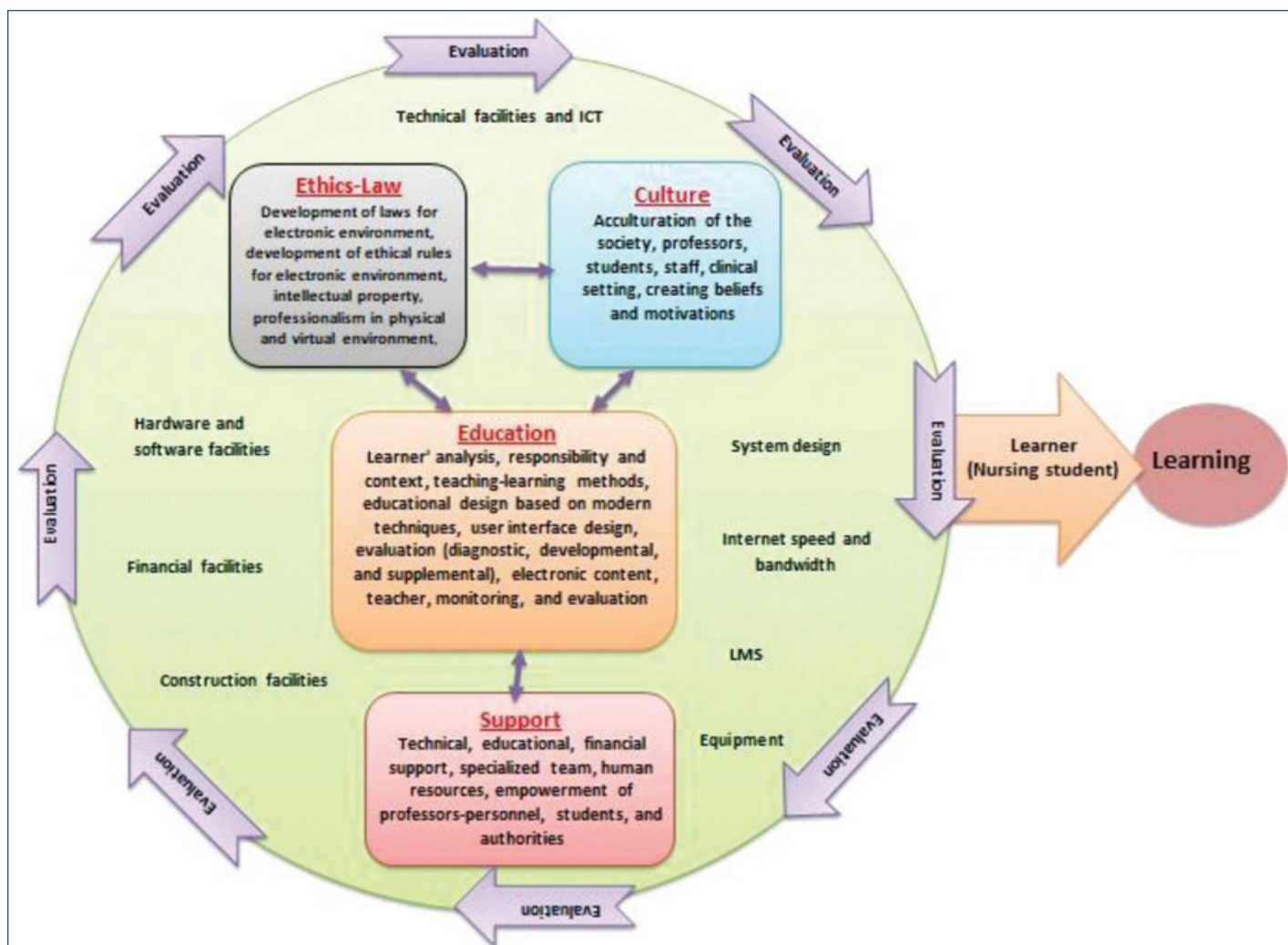
[Table/Fig-4]: Primary model of E-learning in nursing.
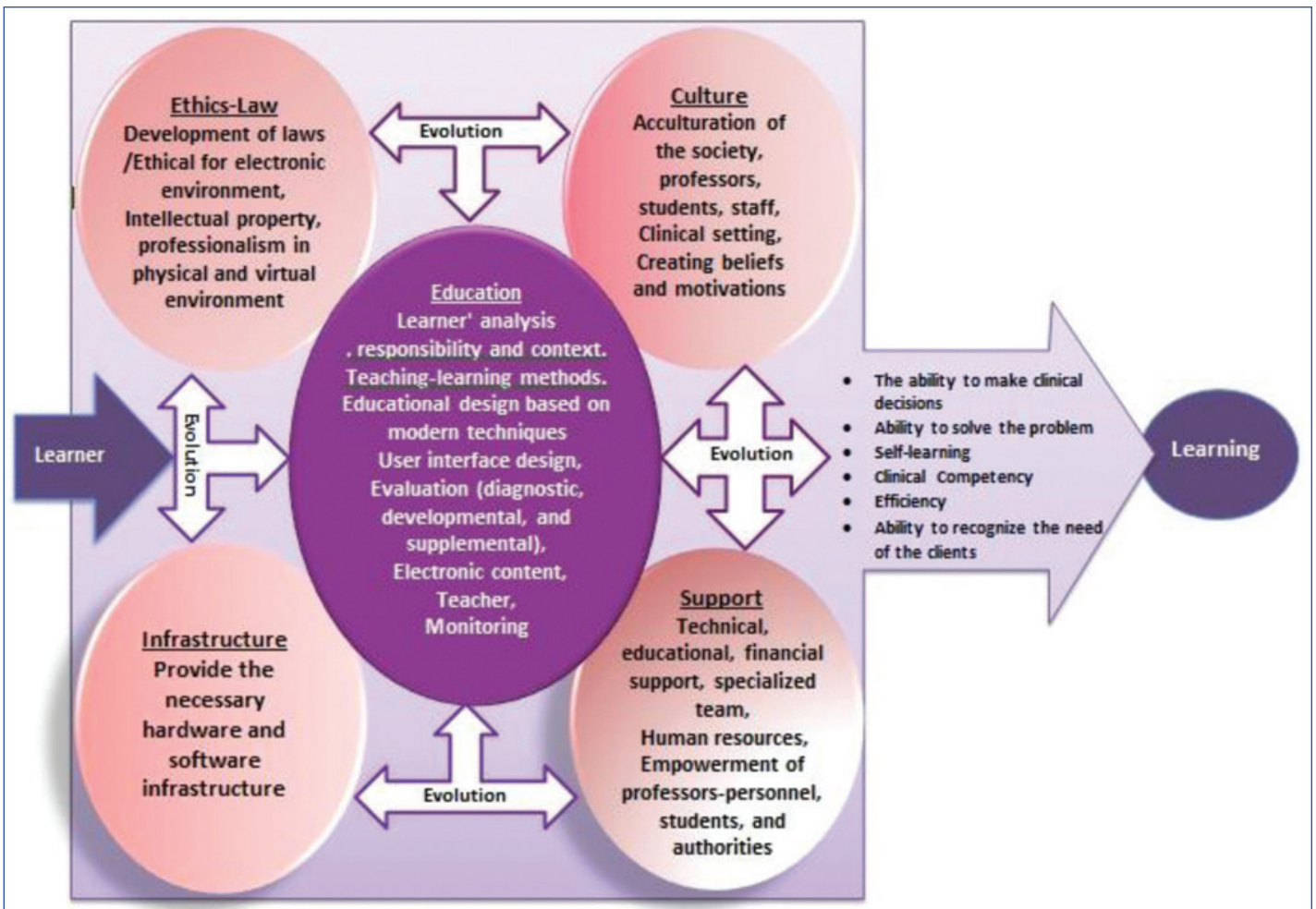
[Table/Fig-5]: Model of E-learning in nursing.

DISCUSSION

E-learning is one of the new and growing methods in education, and it is used in nursing education in many countries, its application in education requires a scientific design which is possible in the form of a model. Therefore, the present study was designed to "Developing an e-learning model for nursing education". In the present study, literature review, interviews with experts, and Delphi method were performed to develop an e-learning model. The proposed model contains seven components with their subcomponents: 1) Infrastructure with necessary hardware and software as its subcomponents; 2) Support with subcomponents as technical, training, and financial support; expert team; human resources; empowerment of the faculty, personnel and students; and authorities' support; 3) Education with subcomponents as learner's analysis, responsibility and background; teaching-learning methods; training based on modern technologies; user interface design; diagnostic, formative as well as summative evaluations; electronic content; instructor; and monitoring; 4) Evaluation with subcomponents as evaluation of content, faculty, courses, user and system; 5) Ethics/Law with subcomponents as making laws for electronic environment, development of ethical codes for electronic environment, determination of intellectual property, professionalism in physical and virtual environment, and control; 6) Culture with subcomponents as acculturation of the society, professors, students, staff and clinical setting; creating belief and motivation; 7) Learner with subcomponents as student, audience, and user.

In a study by Mirzamahmoodi M, according to faculty and students, five factors were effective in implementing e-learning in Iranian universities: human resources, infrastructure, culture, support and pedagogy [14]. According to experts, teachers, and students of Sebelas Maret University, Surakarta, Indonesia, 5 indicators and 20 sub-indicators (4 for each indicator) affect e-learning in their

universities, including: 1) University participation, with sub-indicators of university policies in financial, monitoring, technical support; holding seminars and training; 2) The quality of infrastructure and systems, with sub-indicators of the level of portable products, credibility of the product, ease of learning and use, and design of user interface system; 3) The quality of design and courses, with sub-indicators of course design, course content, completeness of content, and flexibility in taking courses; 4) Students' characteristics, with sub-indicators of student's insight and expertise in relation to the use of computer, attitudes toward e-learning and existence of forums; 5) Teachers' characteristics, with sub-indicators of their attitude toward students, quick response, energetic speaking, and their attitude toward e-learning training [4].

This model has been tried to use a systematic instructional design in the model because it helps learners achieve training objectives. Instructional design is based on the theories of learning, information technology, systematic analysis and management techniques, and its main components include methods, learners, evaluation and objectives [29]. The present model was designed based on objectives, content, and existing facilities, taking into account learners' (nursing students') characteristics, where the learner is regarded as one of the main components of the model. Another advantage of this model is its pedagogic perspective in the education component and in the process of teaching and learning.

Mynbayeva A et al., believes, as for the advances of 21st century technology and the generation of z, Educational pedagogy has changed "science of upbringing, teaching and learning" to the "science of upbringing and education", therefore it is necessary to pay attention to the principles of pedagogy in the process of e-learning [30].

In this perspective, attention is paid to education and training in setting objectives, content, learner's analysis, contextual analysis, analysis of objectives, analysis of responsibility, organisation of

components, educational techniques, learning theories, presentation of subjects according to learner's background knowledge, student orientation, learners' individual differences, learning outcomes, fostering essential skills in learners (ability to make clinical decisions, problem-solving, self-education, clinical competency, efficiency, identifying the patient needs), establishing interaction in online and offline space, relating to audience needs, attractiveness and interaction of content, attention to user interface in terms of attractiveness, ease of use, flexibility, consistency with learners' learning pace, speed of information transmission and site design, attention to various evaluations (diagnostic, formative, and summative) and production of standard electronic contents.

According to Czerkawski BC and Lyman EW, successful pedagogic factors in e-learning in higher education are attitudes toward students, individual's technical capabilities, interactive content, content analysis, learner analysis, analysis of objectives, analysis of media, approaches to design, organisation, teaching strategies, use of web-based learning facilitators, frequency and structure of feedback to learners, university competence/background, professional training in developing the profession, and contact with learners [31]. Straker HO et al., believes, It is essential to integrate various e-learning approaches and combine them with active teaching pedagogies to overcome challenges, meet educational goals and promote competence and future graduate success [32].

As for culture, comprehensive acculturation should be first carried out from the university environment (professors, students, staff, and clinical environment) to the society before using any modern educational technique, especially electronic techniques with their own features, so that the belief and motivation can be generated in all. The cultural factor is one of the important factors in adopting technology-based education systems. The cultural factor is one of the important factors in adopting technology-based education systems. Aparicio M et al., consider cultural factor as one of the important factors in adopting technology-based education systems [33]. Stathopoulos F, believes that students' cultural norms are very important in technology-based teaching and they should be taken into consideration when planning and delivering these training methods. The content elements of each course must be synchronised with these beliefs and norms. Without considering cultural beliefs and methods of the audience, education cannot have a significant impact on students' learning experiences [34].

The dominant teaching technique in Iran is traditional and in-person at all levels and therefore changing the culture of learners and creating concepts such as lifelong or ongoing learning, student-oriented learning, and active and dynamic learning requires extensive and comprehensive planning, in which all educational factors should be engaged. Moreover, positive motivation in those involved leads to its success.

In terms of infrastructure and support, one of the main issues in implementation of e-learning, especially in Iran, is that it is not yet ready as shown in some studies [14]. Therefore, it is essential that the perspective of educational managers and policy-makers change and improve with regard to providing software and hardware infrastructures, human resources, and empowerment of faculty, staff and students. Managers and policy-makers should become aware of the principles and concepts of this educational method so that they can support executors on the occasion of policy-making and operationalising related plans with regard to legislation and investment. Hence, it is necessary for universities to have computers, high-speed internet, suitable LMS and strong technical and administrative teams to implement it successfully. According to Anggrainingsih R et al., university participation, infrastructure quality, design quality, and academic policies such as financial policies, supervision, technical support, seminars and training are effective on the success of e-learning [4].

With regard to ethical and legal issues, Muhammad A et al., and Olaniran BA and Williams IM, believes that there are problems such as fraud, plagiarism, lack of integrity, copying, neglect and privacy breaches in e-learning environments, and it has made university managers and administrators sensitive to this environment [35,36]. Therefore, it is important to develop ethical codes and laws for electronic environment, recognise intellectual property, professionalism in physical as well as virtual environments and have control. Unfortunately, e-learning-based methods may facilitate plagiarism, violation of other people's rights, violation of copyright for intellectual properties, disregard of values, fraudulence, tainting individuals, cheating, lying etc. Therefore, universities, staff, faculty, and students should be assured of protection of their personal and general information. Thus, it is essential that universities or e-learning services develop relevant rules and protocols, including intellectual property rights, non-violation of individuals' privacy, non-violation of copyright, fraud etc.

Evaluation is an inseparable part of any educational system, especially e-learning because it is provided in different ways, such as offline, online, blended, and mobile. Therefore, it is faced with more challenges compared to traditional and in-person methods. Evaluation is a kind of validation, especially in terms of ensuring the quality of teaching-learning process, justifying the implementation of the program, budgeting and policy-making. Evaluation should contain all external and internal components and dimensions of the model and operational measures, such as the program goals and intentions, content, interactions, infrastructure, technical and support issues, rules and regulations governing the system, LMS and educational issues so that the program can be properly implemented and validated, and learning can be effective. Successful evaluation of the e-learning system is an essential process in the management and development of these types of systems [37]. The importance of evaluating the extent to which the various models, including models of technology adoption model of user satisfaction, the quality of e-learning model has been presented to it. Evaluation of e-learning is not a one-time activity but a complex systematic process that must be carried out in parallel with the development and implementation of education in various aspects [38].

Limitation(s)

Some of the limitations of the study are unwillingness of some experts to be interviewed, not responding questions in Delphi rounds delayed responding to questions in Delphi rounds, and unavailability of full-text of some articles.

CONCLUSION(S)

In this study, different aspects of an e-learning model for nursing education was systematically and scientifically determined, as a result, it will be easy to apply in education. Since the interviewees were from different universities (medical sciences and non-medical sciences). Therefore, this model can also be used in non-medical sciences.

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PARTICULARS OF CONTRIBUTORS:
1.   Ph.D Student, School of Nursing and Midwifery, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
2.   Associate Professor, School of Nursing and Midwifery, Shahid Beheshti University, Tehran, Iran.
3.   Associate Professor, Department of E-learning, Virtual School, Comprehensive Center of Excellence for e-Learning, Shiraz University of Medical Sciences, Shiraz, Iran.
4.   Assistant Professor, Department of Medical Surgical Nursing, Shahid Beheshti Medical University, Tehran, Iran.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Houman Manoochehri,
Associate Professor, School of Nursing and Midwifery, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
E-mail: dr.houmanmanoochehri@gmail.com