

Access this article online
Quick Response Code:

Website: www.jehp.net
DOI: 10.4103/jehp.jehp_1496_20

Training pain management to nursing students: Designing, implementing, and evaluating a mobile-based application

Leila Shahmoradi¹, Mahtab Mehrabanfar¹, Seid Ali Emami Meibodi², Elham Navab³, Hossein Majedi Ardakani², Azita Yazdani⁴, Jebraeil Farzi⁵

¹Department of Health Information Management, School of Allied Medical Sciences, Tehran University of Medical Sciences, Tehran, Iran, ²Department of Anesthesiology, School of Medicine, Tehran University of Medical Sciences, Tehran, Iran, ³Department of Critical Care and Geriatric Nursing, School of Nursing and Midwifery, Tehran University of Medical Sciences, Tehran, Iran, ⁴Department of Health Information Technology, School of Management and Medical Informatics, Shiraz University of Medical Sciences, Shiraz, Iran, ⁵Department of Health Information Technology, School of Allied Medical Sciences, Zabol University of Medical Sciences, Zabol, Iran

Address for correspondence:

Dr. Jebraeil Farzi,
Department of Health Information Technology,
School of Allied Medical Sciences, Zabol University of Medical Sciences,
P. O. Box: 9861615881,
Zabol, Iran.
E-mail: j_farzi@zbmu.ac.ir

Received: 21-11-2020
Accepted: 23-01-2021
Published: 29-10-2021

Abstract:

BACKGROUND: Pain is a common health issue and acute pain is the main problem for patients after surgery and injury. Inadequate and inappropriate management of pain is dangerous and costly for patients and leads to undesirable health effects. To overcome this problem, empowerment of the health-care team, especially nurses, is essential. Today, to improve the quality of health-care provision, various methods are used that e-learning is one of them.

MATERIALS AND METHODS: Based on the studies on pain management, existing parameters were extracted, and according to them, the educational content of the software was approved by nursing professors and anesthesiologists. The Unified Modeling Language diagrams were designed to provide a better understanding of the entities and the order in which the software operates. The software was implemented in the google android studio environment using Photoshop and JQuery mobile. Finally, the software was evaluated by using Questionnaire for User Interface Satisfaction. The software was evaluated by experts and students in two stages. The first stage was evaluated by eight anesthesiologists and nursing professors, and the second stage was evaluated with the participation of 55 undergraduate students and 28 M.Sc. nursing students.

RESULTS: The software was developed with two main modules of training and testing, and sections of the report, about us and exit, and four scenarios for the test section. In the initial evaluation of software by experts with an average of 91.85%, and in the second assessment of students, with a mean of 78.15%, application software was evaluated at a good level.

CONCLUSIONS: In order to teach academic and practical (clinical) materials to students, the use of digital teaching aids and e-learning, along with traditional methods such as lectures, increases the students' eagerness, and motivation to learn more and thereby enhance the level of learning and improving the quality of education.

Keywords:

E-learning, mobile application, nursing, pain management

Introduction

Pain is one of the most prevalent problems for patients who come to the emergency department. Annually, in the United States, 25 million surgical procedures for inpatients and a total of 35 million outpatient surgeries are done.^[1] More than 80% of the patients

who undergoing surgery have postoperative pain and 39% experience severe pain.^[2] In surgical procedures, due to skin cutting, damage to involved soft tissues, and the breakdown of the nerves, as well as the stretching imposed on the tissue, the pain receptors stimulate and cause pain.^[3] Although pain is considered to be the fifth

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Shahmoradi L, Mehrabanfar M, Meibodi SA, Navab E, Ardakani HM, Yazdani A, *et al.* Training pain management to nursing students: Designing, implementing, and evaluating a mobile-based application. *J Edu Health Promot* 2021;10:379.

most important symptom, acute pain is still unstable and is usually managed in a nonoptimal manner.^[4]

Several physiological responses appear if acute pain is not treated, which a change in the vital signs is one of them. Changes in vital signs may require starting an initial dose of the drug. The complication resulting from the nontreatment of acute postsurgical pain is a neuromuscular response that results in tachycardia and an increase in blood pressure and respiratory rate, which further increases the consumption of oxygen in the heart tissue and leads to ischemia or myocardial infarction, hyperglycemia, changes in proteins and fat metabolism, and postoperative complications.

Stress accompanied by the lack of adequate treatment of acute pain can increase the state of coagulation and impairment of inherent and acquired immune activity. Complications of these disorders include thrombophlebitis disease and an increased risk of postsurgical infection. Furthermore, the pain after lung and abdominal surgery causes the patient to not be able to cough and does not clean the respiratory tract, resulting in longer time for the patient to return to normal. As a result, his rehab is disrupted and there is a possibility of re-admission, and due to the length of the treatment period, the complications of the high level of drug abuse and the quality of life of the patient are reduced.^[5] Inappropriate management of acute pain can also appear as an overdose of treatment, in which a large amount of drug or opioids was given to the patient. The consequences of over-treatment are usually overlooked, but can be life-threatening.^[2]

The management of pain was taught to students as part of the principles and nursing skills at the undergraduate level. The teaching methods of the theory include traditional manners such as lectures, PowerPoint presentations and preprepared subjects, and in the practical (clinical) section, the student attends the hospital environment and views through observation. Studies have shown that students in the classroom learn a lot of content, but they quickly forget them.^[6] In addition, some practices and exercises on the patient's bedside are not feasible and endanger his safety.^[7]

Nurses are recognized as the first line in assessing patient pain and taking relief measures. Failure to train the concepts of pain during nursing exercises is a weakness in the management of pain and the lack of important skills, especially the ability of nurses to recognize the signs and symptoms of pain, leads to inadequate management of pain. Using new educational methods and evidence-based learning can help to fix this gap.^[4]

One of the most innovative ways of learning is E-learning. Electronic learning refers to the use of computer, network,

and technology provided through the Internet or intranet and provides information to users.^[8] In other words, E-learning is a collection of applications and IT-based learning practices (computers, compact discs, networks, the Internet, intranets, and virtual universities) that allow life-long learning and educating for each individual in each field, any place and at any time.^[9] Mobile education is a type of E-learning that is newer than other types and is known as M-learning.^[10]

Mobile phones are part of the daily culture of most students and educators. These phones introduce the new types of communication techniques that eliminate spatial and temporal complexities. Handheld and portable tools, by their computational and communication power, promote the classroom dynamics which reinforcement and enhance face-to-face interactions, as well as support collaborative learning scenarios.^[11] In nursing practice, the patient's problems constantly develop and is important for nurses to be able to solve clinical problems. Nurses need to learn problem-solving skills to provide optimal security and care. Experts believe that modern tools and technologies should be used to promote problem-solving strategies. Recent advances in the computer and communication technologies have provided new methods for teaching and learning nurses, which simulates learning topics and scenarios as closely as possible to the real world.^[12]

It is designed many mobile-based application for the treatment and educational aspects.^[13] Research conducted by Dehkordi, Android-based software for bowel inflammatory disease was designed and developed. This was an application for educating people with inflammatory bowel syndrome, in which there were education axes, medical and nutritional reminders, and lifestyle helping to improve the quality of life of patients.^[14]

Considering the importance of learning the concepts of pain and its management, the present study aimed to design and develop pain management software for teaching nurse students of Tehran University of Medical Sciences and Health Services, as well as evaluating its applicability.

Materials and Methods

Study design and setting

The present study is an applied-developmental study and the research community consisted of two groups of anesthesiologists and nursing teachers and B.Sc. and M.Sc. nursing students in Tehran University of Medical Sciences and Health Services.

Study participants and sampling

In this study, fifteen specialists include seven physician

and eight nursing professors were trained in. In the next step, by using specialized articles and texts and sites related to pain management, and with related guidelines, also consulted with anesthesiologists and nursing practitioners, pain parameters, and management were developed that form the content of the software. These parameters were arranged in a questionnaire. The questionnaires were distributed among the panel of experts (15 people). According to the Lawshe table^[15] and considering the number of expert panels that were 15, the items that scored less than 0.49 were excluded from the study. Out of 64 items in the questionnaire, 19 items did not get the required score, and the rest were considered in the software training section and its contents. Its validity was confirmed by subject specialists through Content Validity Index. Its reliability was confirmed by a test-retest and Spearman test (0/9).

Data collection tool and technique

After consulting and surveying experts, 4 tests were considered for the software. In order to better understand the entities and software operation, the use-case, activity, and sequence diagrams were drawn up using visual paradigm for Unified Modeling Language software. Graphic design was done by the Adobe Photoshop and JQuery mobile software and coding was done in the google android studio environment. After completion, the software was distributed to 83 nursing students, and they were asked to work 1 week with that. In order to assess and evaluate students' satisfaction, Questionnaire for User Interface Satisfaction (QUIS) 7.0^[16] questionnaire was used to assess the applicability of the software. According to the software features, some unrelated items were removed, and the questionnaire with 20 questions and Likert scale 9-0 were adjusted. The questionnaires included the general user's perspective on working with the system (5 questions), the screen (4 questions), the system's terminology and information system (3 questions), system learning capabilities (5 questions), and overall system capabilities (3 questions). After collecting questionnaires, the data were entered into IBM SPSS 17 Statistics software and analyzed.

Ethical consideration

Questionnaires distributed among specialists in the first phase to confirm the content of the software and in the evaluation phase to determine the applicability of the software between the panel of specialists and nursing students, were read with their full consent and complete confidentiality about the identity information of individuals. Participant in the study was observed. Participants were assured that the results would be used for research purposes only.

Software description

The pain management software is an apk executable

file that can be installed on the Android smartphone platform. After installing the software and running it, the screen splash (three screens showing the quick and easy browsing of the application's features) was shown, and in the background, it downloads the software. The home page of the program has two main modules of teaching concepts and tests and the subsections of the report, about us and the exit button [Figure 1].

Software application sections:

1. Training: Students can study the contents and concepts of pain, patient, evaluation, medications, and actions [Figure 2]
2. Test: This part is the most important part and main module of the software consisting of four parts, each of them is related to a specific disease, and the student can choose any one of them. Each test includes the following steps: history, physical examination, vital signs control, pain measurement, medical records, and measures [Figure 3]
3. Report: For each test, there is a workbook in which positive points are given for correct answers and negative points are recorded for false answers. At the bottom of the workbook, there is a section called "Do you know" that it includes items about the patient being evaluated, diagnosed, and treated [Figure 4]
4. About Us: The names of application makers, tutors, and consultants are included here.

Results

For the content development of software, a content approval questionnaire was used which included 64 cases in six sections. Some items in the questionnaire did not get the required score and were deleted so they were not used to develop software content. For the first part of the concept of the patient, the item definition of pain and pain management, for concepts related to patient three items education, the results of laboratory tests

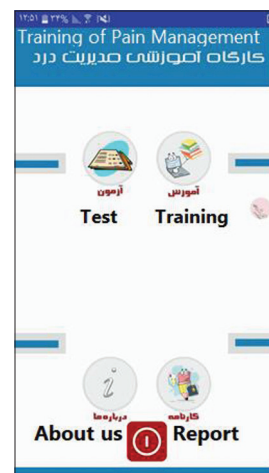


Figure 1: Home page



Figure 2: Concepts training page

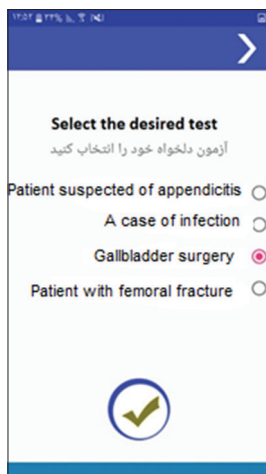


Figure 3: Test page

Operation on Gallbladder				
User activities		True	False	Score
Physical examination	Abdominal examination	True	False	4
Control vital signs	pulse	True	False	2
	body temperature	True	False	2
	respiration rate	True	False	2
	blood pressure	True	False	2
Measuring the severity of pain	VDS	True	False	
	FACES	True	False	3
	VAS	True	False	
	NRS	True	False	
Actions	Cold compress on the surgery site	True	False	
	Observing the instructions after surgery	True	False	2
	Attention to internal physicians in terms of heart and lung problems	True	False	2
	Slow intravenous morphine injection	True	False	2
	Use of an intravenous or rectal analgesic	True	False	2
	Use of paracetamol orally or by injection	True	False	2
			True	False

Figure 4: Report page

and the operation time, from the concepts of assessing pain, verbal descriptions, from the drugs, ibuprofen, naproxen, celecoxib, diclofenac, oxycodone, tramadol, morphine, methadone, and fentanyl, the method of two items electrical nerve stimulation and acupuncture and

the functional capabilities of the system, the ability to display the date and time and name user, did not get the required score and were excluded from the study. Based on the residual and confirmed items, the software was designed and developed.

Evaluation

Initially, the software was evaluated by experts and professors participating in the verification phase of the questionnaire. The software was installed on the phone of eight specialists and asked them to work with the software for 2 weeks. QUIS was then given to them. Table 1 shows the data for analyzing the data from the survey questionnaires:

For better understanding the results of the Quiz questionnaire, the responses were categorized into three groups: weak (0–3), moderate (4–6), and good (7–9). Table 1 shows the percentage of expert responses and Table 2 shows the percentage of student responses. As can be seen, the experts participating in the first assessment phase, in most cases, have verified the applicability of the software with a high percentage and around 100%. Only one that is poorly reported is item number five of the questionnaire. That is, “continuous work with the system,” which is 12.5% weak, 50% average. % 37.5 rated it well.

After this stage, the application was given to the BS and MS nursing students of the Faculty of Nursing and Midwifery of Tehran University of Medical Sciences and Health Services. Students were asked to install the software on their phones and complete the survey forms after 2 weeks of work. Table 2 shows the results of the analysis of data related to the survey form.

The overall results of the nursing student’s evaluation showed that the software usability was about 15.67% at the good level and 5.82% at the average level [Table 2]. Totally, nursing students were satisfied by this mobile application.

The questionnaire which was utilized for assessment of this application was QUIS. It is an apparatus created by a multi-disciplinary group of analysts in the Human-Computer Interaction Lab at the University of Maryland at College Park.^[12,16] In this study, to reveal the reliability of the questionnaire survey, reliability analysis is conducted. To evaluate the questionnaire in terms of reliability, the questionnaire was distributed in two stages among 30 available specialists (15 health information managers, 7 pain specialists and 8 nursing specialists) and its reliability by halving method with coefficient Spearman correlation was examined. The second phase was 3 weeks after the distribution of the first phase when the results were analyzed by IBM SPSS Statistics 17, Armonk, NY, USA. The acceptable value of

Table 1: Evaluation of software by specialist

Subject	Weak (0-3) (%)	Moderate (4-6) (%)	Good (7-9) (%)	Number of experts
System functionality	0	0	8 (100)	8
System hardness	0	0	8 (100)	8
You're feeling about working with the system	0	0	8 (100)	8
Overall system design	0	1 (12.5)	7 (87.5)	8
Continuous work with system	1 (12.5)	4 (50)	3 (37.5)	8
The readability of letters on the screen	0	1 (12.5)	7 (87.5)	8
Perform easy tasks using specific expressions in the system	0	0	8 (100)	8
Organize information	0	0	8 (100)	8
Screen sequence	0	1 (12.5)	7 (87.5)	8
Use the terminology in the system	0	0	8 (100)	8
The location of the messages on the screen	0	1 (12.5)	7 (87.5)	8
System error messages	0	2 (25)	6 (75)	8
Learn to work with the system	0	0	8 (100)	8
Find system properties through trial and error	0	0	8 (100)	8
Remembering and using system capabilities	0	0	8 (100)	8
Perform tasks fast and easy	0	0	8 (100)	8
Help message on screen	0	0	8 (100)	8
System speed	0	1 (12.5)	7 (87.5)	8
System availability	0	0	8 (100)	8
Number of system capabilities	0	1 (12.5)	7 (87.5)	8
Total mean	0	7.52	91.85	

Table 2: Evaluation of software by nursing students

Subject	Weak (0-3) (%)	Moderate (4-6) (%)	Good (7-9) (%)	Number of students
System functionality	3 (3.6)	20 (24.1)	60 (72.3)	83
System hardness	6 (7.2)	10 (12)	67 (80.7)	83
You're feeling about working with the system	4 (4.8)	18 (21.6)	61 (73.5)	83
Overall system design	3 (3.6)	19 (22.8)	61 (73.5)	83
Continuous work with system	8 (9.6)	25 (30.1)	50 (60.2)	83
The readability of letters on the screen	5 (6)	5 (6)	73 (88)	83
Perform easy tasks using specific expressions in the system	7 (8.4)	7 (8.4)	69 (83)	83
Organize information	8 (9.6)	10 (12)	65 (78.3)	83
Screen sequence	4 (4.8)	13 (15.6)	66 (79.5)	83
Use the terminology in the system	3 (3.6)	13 (15.6)	67 (80.8)	83
The location of the messages on the screen	4 (4.8)	13 (15.6)	66 (79.5)	83
System error messages	5 (6)	16 (19.2)	62 (74.7)	83
Learn to work with the system	5 (6)	11 (13.2)	67 (80.8)	83
Find system properties through trial and error	6 (7.2)	10 (12)	67 (80.8)	83
Remembering and using system capabilities	5 (6)	10 (12)	68 (82)	83
Perform tasks fast and easy	5 (6)	11 (13.2)	67 (80.8)	83
Help message on screen	6 (7.2)	9 (10.8)	68 (82)	83
System speed	6 (7.2)	13 (15.6)	64 (77.2)	83
System availability	3 (3.6)	14 (16.8)	66 (79.5)	83
Number of system capabilities	6 (7.2)	14 (16.8)	63 (75.9)	83
Total mean	5.82	15.67	78.15	

Spearman correlation coefficient is in the range of 1 and 1, which in the research was 0.9 for the items in question, which indicates the reliability of the questionnaire. Expert responses to the questionnaire in the first and second distributions are largely with they matched.

Discussion

In this research, the requirements of Android-based

software design for pain management training is considered for nursing students. Since there are various topics on the nursing theory, and most of trainings are practical, using new types of learning and new educational methods, such as e-learning and mobile-based, is necessary.^[17]

Evaluation of pain management training software was performed in two stages. First stage, the software was

installed and applied on the phones of eight medical and nursing specialists for a week. At the end of the application period, the QUIS with 20 questions consisted of a 0–9 Likert scale was provided to the experts to assess their satisfaction. At this stage of the evaluation, users included four anesthesiologists and four nursing specialists. The number of 19 responses had an average of higher than 7.5 with only one response on average of 6.5, which was related to the continuous work with the system. Because of the limited and small number of scenarios, this section was evaluated at an intermediate level. According to the three categories: weak, medium, and good, the experts evaluated the software, 0% at a weak, 7.52% at an average and 91.85% at a good level in the frequency table. In the second stage of evaluation, the software was provided to 83 undergraduate and graduate nursing students included 55 undergraduate students and 28 postgraduates, and their satisfaction was measured by QUIS. To achieve the right result, third, fourth, and fifth semester students were selected because they had taken courses related to pain and its management. Furthermore, they had the necessary information about this topic. In the central part of a questionnaire, “Your general opinion about working with the system,” the average was 7.15, which was at a good level. Only the section “Continuous operation with the system” had an average of 6.44, which was evaluated at the intermediate level similar to the evaluation of the first stage due to the limited scenarios. The fourth axis “System Learning Capability” with an average of 7.73 and the fifth axis “General System Capabilities” with an average of 7.67 were evaluated at a good level. In this research, 5.82% of the students rated a software at a weak, 15.67% at a moderate, and 78.15% at a good level.

In a study by Safdari *et al.*, educational simulator of software in computer-based cardiovascular resuscitation has been designed and developed. In addition to the training workshop, there are several tests in this software to assess students’ learning. The results of this study are along with the satisfaction of software users and general sections of the system are parallel with the current research. It is notable that the software of the cardiopulmonary resuscitation simulator for being dynamic and user interactivity with the Simulated educational environment has more advantages.^[18]

Research done by Dehkordi is the design and creation of an Android-based therapy software to educate people with bowel inflammatory disease, which focuses on educating users. In the survey from users of this program, the level of satisfaction and acceptance of the program was as good as the present study. More addition, this program would not have an option to measure the level of user learning.^[14]

In a study published by Wu *et al.* first via collecting demographic questionnaire, background information about the child and caregiver, the necessary needs assessments were performed on the design of the ability to regulate drug use and appointment reminders. After that, identifying and analyzing the needs of users, a prototype of the software was designed. Users’ opinions were collected after working with the prototype. Furthermore, the users’ desired capabilities and their educational needs were identified and prioritized. Each of software sections is divided into sub-sections. In the anticonvulsant drugs section, a drug reminder is embedded so that the caregiver can enter the name of his or her child’s medication in the medication name field and specify and record the desired time. Based on the given time, the reminder sounds at a certain time and a message is displayed on the phone screen.^[12] This tool is created only for training caregivers and there is no test to check their level of information. The distinguishing feature of pain management training software is having different tests to check the user’s level of learning, in addition to having an educational section. The user can measure the level of his information by performing tests.^[19] In the report card provided by the software, the user’s mistakes are displayed with a negative score and more details. The user can also repeat the desired test several times and correct his mistakes. On the other hand, this application has the ability to communicate with the Internet, which is superior to the present study.

Chin *et al.* in their research with the help of a set of metrics, evaluate smartphone applications with operating systems. In this study, QUIS 7.0 was used to evaluate the usability of mobile applications and user satisfaction.^[16] The present study is in line with the use of QUIS with the two mentioned studies. However, in this study, according to the characteristics of the system, some questions were deleted and a questionnaire with 20 questions was prepared, which was finally provided to experts and students.

The results of many studies indicate that designing and using mobile applications in the field of education can be effective in better learning and improving the quality of student education.

Limitation and recommendation

One of the limitations of this study is the impossibility of creating more and more diverse scenarios for patients such as burns, children and infants and the lack of sufficient time to evaluate the impact of pain management training application and compare it with classroom teaching methods. It is suggested that software such as pain management for children and infants, pregnant women, chronic pain be designed and developed to complete the work.

Conclusions

The focus of this study was on the design and creation of software and educational content. To achieve better results, it is necessary that this software has been tested and compared with the traditional lecture method in the class, for result analysis. Developing new learning and teaching methods is a new challenge in teaching theoretical courses, especially clinical lessons and practical skills. Using interactive methods such as smart phone software as well as interactive games will help students to learn in a dynamic and entertaining environment, to test their knowledge and skills safely, and to examine the quality level for learning improvement.

In this study, Android-based application software was designed and developed to educate nursing students and was evaluated by nursing specialists and students. Considering the necessity of new learning methods based on information and communication technologies and the evaluation results of the software which are presented in this study, using educational software is more efficient for learning and education quality improvement. It helps in theoretical debates and integrates with clinical practice.

Acknowledgment

This article is the result of a master's degree dissertation in the field of health information technology that was conducted at the School of Allied Medical Science, Tehran University of Medical Sciences, and it has the ethical code IR. TUMS. SPH. REC.1395.1883.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Dale J, Bjørnsen LP. Assessment of pain in a Norwegian emergency department. *Scand J Trauma Resusc Emerg Med* 2015;23:86.
2. Argoff CE. Recent management advances in acute postoperative pain. *Pain Pract* 2014;14:477-87.
3. Tavakoli A, Norouzi M, Hajizadeh E. Patients' satisfaction from pain soothing after the surgery in Kerman Hospitals. *J Kermanshah Univ Med Sci* 2007;11:206-14.
4. Drake G, de C Williams AC. Nursing education interventions for managing acute pain in hospital settings: A systematic review of clinical outcomes and teaching methods. *Pain Manag Nurs* 2017;18:3-15.
5. Dunwoody CJ, Krenzischek DA, Pasero C, Rathmell JP, Polomano RC. Assessment, physiological monitoring, and consequences of inadequately treated acute pain. *J Perianesth Nurs* 2008;23:S15-27.
6. Khatooni M, Alimoradi Z, Sibni FS, Shafiee Z, Atashi V. The impact of an educational software designed about fundamental of nursing skills on nursing students' learning of practical skills. *Journal of Clinical Nursing and Midwifery* 2014;3:9-16.
7. Radhakrishnan K, Roche JP, Cunningham H. Measuring clinical practice parameters with human patient simulation: A pilot study. *Int J Nurs Educ Scholarsh* 2007;4:Article8. doi: 10.2202/1548-923X.1307. Epub 2007 Feb 21.
8. Welsh ET, Wanberg CR, Brown KG, Simmering MJ. E-learning: Emerging uses, empirical results and future directions. *Int J Train Dev* 2003;7:245-58.
9. Farhadi R. Electronic education: New paradigm in information era. *J Sci Inform Technol* 2006;21:18.
10. Kia AA. Take a Look at Virtual Training (Electronic). *Social Science Quarterly Book Review*. Tehran: Institute for Humanities and Cultural Studies;2010;24 p. 1-8.
11. Botzer G, Yerushalmy M. Mobile Application for Mobile Learning. In: *Proceedings of IADIS International Conference on Cognition and Exploratory Learning in Digital Age (CELDA 2007)*; 2007. p. 7-9.
12. Wu PH, Hwang GJ, Tsai CC, Chen YC, Huang YM. A pilot study on conducting mobile learning activities for clinical nursing courses based on the repertory grid approach. *Nurse Educ Today* 2011;31:e8-15.
13. Shahmoradi L, Ahmadi M, Haghani H. Determining the most important evaluation indicators of healthcare information systems (HCIS) in Iran. *Health Inform Manag J* 2007;36:13-22.
14. Dehkordi SK. Design and Implementation of a Self-Management Mobile Application for Patients with Inflammatory Bowel Disease (IBD) [Master's thesis]. Tehran: Tehran University of Medical Sciences; 2016.p. 110-115
15. Lawshe CH. A quantitative approach to content validity. *Pers Psychol* 1975;28:563-75.
16. Chin JP, Diehl VA, Norman KL. Development of an Instrument Measuring User Satisfaction of the Human-Computer Interface. In: *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM; 1988. p. 213-8.
17. Alvarez AG, Dal Sasso GT, Iyengar MS. Persuasive technology in teaching acute pain assessment in nursing: Results in learning based on pre and post-testing. *Nurse Educ Today* 2017;50:109-14.
18. Safdari R, Charkhsaz N, Montaseri MA, Montaseri N. Survey the effect of CPR simulation training software on the satisfaction of operating room and medical emergency students in Tehran University of medical sciences. *J Nurs Educ* 2017;5:1-10.
19. Shahmoradi L, Changizi V, Mehraeen E, Bashiri A, Jannat B, Hosseini M. The challenges of E-learning system: Higher educational institutions perspective. *J Educ Health Promot* 2018;7:116.