The Effect of Using Appendectomy Surgical Simulation Software (Game-Based) on the Satisfaction of Undergraduate Students of Operating Room in Isfahan, 2017

Amin Sedigh
School of Nursing and Midwifery
Isfahan University of Medical Sciences
Hezar Jerib Street, Isfahan, Iran 8174673461
Phone: +98 31 3792 3071

Ahmad Ghadami
School of Nursing and Midwifery
Isfahan University of Medical Sciences
Hezar Jerib Street, Isfahan, Iran 8174673461
Phone: +98 31 3792 3071
ghadami@nm.mui.ac.ir

Arash Najimi
Isfahan University of Medical Sciences
Hezar Jerib Street, Isfahan, Iran 8174673461
Phone: +98 31 3792 3071

Masood Sayyadi
Isfahan University of Medical Sciences
Hezar Jerib Street, Isfahan, Iran 8174673461
Phone: +98 31 3792 3071

Abstract

One of the main challenges of the educational centers is the introduction of modern teaching methods. Using the simulation devices in training is getting increasingly popularity. The purpose of this study was to examine the effect of appendectomy surgical simulation software (game-based) on the satisfaction of undergraduate students of operating room in Isfahan.

In this single-blind randomized clinical trial, 70 second semester undergraduate students were divided into control group and Intervention group after obtaining satisfaction by random allocation. After using the simulation software (game-based) for the Intervention group and the holding practice and lecture class (routine method) for the control group, the data were collected by a self-administered questionnaire the validity and reliability of which were confirmed. Data were then analyzed by SPSS software version 16 and descriptive and analytical tests were also analyzed at a significance level of 0.05.

The results showed that the average satisfaction score of the Intervention group (58.94 ± 2.63) was higher than the control group (43.20 ± 3.02) and this difference was statistically significant (P-value <0.05). The results also showed that there was a significant relationship between age and satisfaction (P-value <0.05). This means that as age increases, satisfaction increases ($r = 0.26$).

Appendectomy surgical simulation software (game-based) can improve the students' satisfaction with the training process. Therefore, appendectomy surgical simulation software (game-based) is recommended as a supplementary training method.

Keywords: Software; Game-Based; Simulation; Surgical; Appendectomy; Satisfaction; Undergraduate; Students; Operating Room; Training.

1. Introduction

The operating room undergraduate degree is one of the disciplines of the medical sciences whose main goal is to train experts who can effectively participate as a member of the surgical team (Duers & Brown, 2009). In Iran, students are awarded a bachelor's degree in operating room field after 4 years. The operating room is a complex system in which staffs, technologists and patients are organized to provide patients with favorable outcomes (Hosseini et. al., 2017). Nursing education incorporates both theoretical knowledge and clinical activities, so that appropriate clinical care should be provided based

on the theoretical knowledge (Rikhotso & Williams, 2014). Clinical experience is the core of nursing education (Aliafsari & Zamanzade, 2017). Helping, guiding and supporting students through clinical education with the aim of raising their qualifications and clinical performance through a creative environment enhances the nursing profession (Henderson et. al., 2011).

Clinic is the only place that integrates theoretical knowledge and clinical practice. (Henderson et. al., 2011) The more training a student is richer, the better the performance of students will be. The first experiences of nursing and medical students in the operating room with actual patients are always stressful and threatening. Novices, without a defined role, feel a high pressure from working with experienced people. The student is aware that he/she may endanger the patient's safety, and tends to remain passive in order to prevent mistakes. As a result, novices feel that they are not effective in prospective decision making and therefore have a negative self-image (Del Blanco et. al., 2017). Therefore, the complexity of learning in the clinical setting has made researchers examine clinical education from a variety of dimensions and bring about innovations in educating clinical students (Assadi et. al., 2014).

The introduction of new teaching methods has created challenges in education, especially in medical sciences (Karimimonghi et. al., 2013). Training practitioners have been always trying to make the most of the facilities (Abnavi & Ghadami ,2017).In-class or traditional educational environments have been criticized for the reasons such as encouraging passive learning, ignoring learners' differences and needs, ignoring problem-solving skills, critical thinking, or other high-level thinking. Thus, given that the people are entitled to receive medical services from the potent experts, the method of education gains high importance (Roghani et. al., 2006). New advances in technology have provided a variety of tools to enhance learning in higher education. Computer simulation training has gained popularity due to the change in the style of learning, the facilitation of thinking and the creation of higher problem solving skills (Koh et. al.,2010).

Virtual reality technology has been used in various occupational training programs including surgery since decades ago. Humanoid and mannequin simulators reduce anxiety and facilitate students' acquisition of skills. They reduce errors and the probability of harm. They can be used at all levels of nursing education (Ricketts, 2011). In simulation method, it is attempted to adapt the learning conditions to the real conditions so that the learning materials to be transmitted to the real-world context. This method reduces the complexity of learning that is prevalent in the real world (Faraji, 2013, Wilford & Doyle, 2006). The reason of using the educational video games is their growing popularity.

These kind of educational games that are primarily aimed at education and learning rather than entertainment have made many advances and lack some of the problems and limitations of the traditional way. These games should be amusing and have some of the main aspects of the game such as challenge, risk, reward and loss (Sabri et. al., 2010). However, simulation training can neverre place practical training (Xiao et. al., 2014).Since the students are the important elements and the main audience of higher education, their viewpoints are now considered globally as an essential factor in monitoring the quality of education at the universities (Ashrafsadat, 2013). Therefore, students' satisfaction with education is of high importance. In order to increase students 'satisfaction, universities need to gather information about students' attitudes toward the services provided. Then, drawing on this information, the students, the positive factors of satisfaction will be boosted and the negative factors will be corrected (Zaribaf et. al., 2013).

Application of the new method in teaching practical skills in the operating room experts was considered by the researchers, but limited studies have been done on the students' effectiveness and satisfaction with game-based simulation. Therefore, considering the importance of the issue, this study aimed to examine the effect of using appendectomy surgical simulation software (game-based) on the satisfaction of undergraduate students in the field of operating room in Isfahan.

2. Methodology

This study is a single-blind randomized controlled clinical trial. The study environment was the Faculty of Nursing and Midwifery of Isfahan University of Medical Sciences and the population

consisted of all second semester undergraduate students in the field of operating room. Firstly, all students were selected by the convenience sampling method. After applying the criteria of entry and approval of participation in the study, 70 students were randomly assigned to two groups (control and Intervention) of 35 persons were tested and tested. Entry criteria included being undergraduate students of the operating room and having the basic knowledge and ability to work with the computer.

In the control group, a practice session was held for two hours to familiarize the participants with the appendectomy and surgical equipment (lecture-presentation method using PowerPoint) and then the students observed the appendectomy surgical instrument with the presence of the researcher. In the Intervention group, during a two-hour session, the samples were introduced to the appendectomy (game-based) simulation software, and then the students completed the stages of the game for practice in the presence of the researcher.

The content of the software was developed in a scenario based on referrals related to the operating room and under the supervision of a qualified surgeon and then given to the developer for programming. The data collection tool was a self-administered satisfaction questionnaire that comprised 17 questions and measured student satisfaction with the course they attended. The questions were designed in Likert scale including the choices strongly agree (Henderson et. al., 2011), agree (Aliafsari & Zamanzade, 2017), no idea (Rikhotso & Williams, 2014), disagree (Hosseini et. al., 2017) and totally disagree (Duers & Brown, 2009). The minimum score of the questionnaire was 17 and the maximum was 85. The desirable satisfaction criterion is getting a score higher than 51 and poorer satisfaction score waslower than the 51. The questionnaire validity was confirmed through a survey of 10 members of the faculty. Reliability of the satisfaction questionnaire after the pilot Cronbach's alpha coefficient was 0.86. The data were analyzed by SPSS ver.16 using descriptive and analytical statistics (Chi-square, Pearson, Mann-Whitney, and Kolmogorov-Smirnov tests) at a significance of 0.05.

3. Results

In this clinical study, 70 undergraduate students were selected and randomly divided into two groups: control and Intervention to examine the effect of the application of appendectomy surgicalsimulation software (game-based) on students' satisfaction. Of the 70 students under study, 43 (61.4%) were women and 27 (38.6%) were male. The average age of the population under study was 20.23 ± 1.8 and the average grade of education was 17.14 ± 1.50. The frequency distribution of the demographic characteristics of the population under investigation in two groups of control and Intervention is shown in Table 1.1. There was no significant difference between the two groups in terms of age, gender, and average score (P-value> 0.05). The results are based on Chi-square and Mann-Whitney non-parametric tests at a significance of 5%.

Table 1. Determining and comparing frequency distribution gender in two groups

Variable		Group		Total	Significance
		Intervention	Control		
Gender	**Male**	13 (37.1%)	14 (40.0%)	27 (38.6%)	0.81
	Female	22 (62.9%)	21 (60.0%)	43 (61.4%)	
Total		35 (100.0%)	35 (100.0%)	70 (100.0%)	

Table 2. Determining and comparing gender and educational average frequency distribution in two groups

Variable		mean	Standard deviation	number	Significance
Age	Control	20.14	1.17	35	
	Intervention	20.31	1.21	35	0.88

Educational average	Control	17.03	1.60		35	0.55
	Intervention	17.25	1.42		35	

The results showed that the average score of satisfaction in the Intervention group was significantly higher than the control group (P-value <0.05) (Table 2.1). Considering the higher average score of students in the Intervention group (58.94 ± 2.63 of the criterion of this questionnaire i.e. 51) the satisfaction was desirable in this group, while the average score of students in the control group (43/20±3/02) was less than the criterion that indicates that the students in the control group are dissatisfied with the training. The results are based on the Mann-Whitney non-parametric test at a significance of 5% (due to the fact that the distribution of satisfactory score is not normal based on Kolmogorov-Smirnov results(P-value = 0.001 <0.05)).

Table 3. Determination and comparison of the average satisfaction score of undergraduate students of the operating room between the control and Intervention groups

	group	number	mean	Standard Deviation	Average Standard Deviation	Significance
Satisfaction	Control	35	43.20	17.88	3.02	
	Intervention	35	58.94	15.59	2.63	0.001*

The results also showed that there was no significant difference between the mean score of satisfaction of male and female students (P-value> 0.05). Also, the results showed that asage increases, satisfaction score increases significantly (r = 0.26)(P-value <0.05*).

4. Discussion

The process of choosing educational methods is not merely based on learning and evaluation of learners, and educators must pay due attention to the satisfaction of learners as well. The satisfaction of learners with the educational method can affect their academic achievement (Khoobi et. al., 2015). In recent years, using animation as a learning tool for learning improvement became popular (Entezari et. al., 2013), but no study has been found to examine the impact of game-based surgery simulation software.

of this study was to investigate the effect of using Appendectomy surgical simulation software (game-based) on the satisfaction of second semester undergraduate students of the operating room. The results of the study showed that using simulation software leads to increased satisfaction of the students. Their satisfaction after intervention in the Intervention group was higher than the control group. There are different studies in this area that their results agree with our study. For example, in a study by Shakour et. al. in 2013 titled "The Effect of Educational Game on Students' Satisfaction and Academic Achievement in Anatomy," second semester students of Isfahan University of medical sciences were under the study. The research sample included all students who participated in sessions of the game (Intervention group) and in the usual classroom sessions (control group).

To examine the effectiveness of the game, two forms of the game were played in two sessions, arrangement games and the game of finding concepts and writing on the body's anatomy images. To assess the impact of the game on the academic achievement of the Quiz test was used which was typically given at the end of each session. A survey questionnaire was used to assess students' satisfaction. Analyzing the satisfaction questionnaire revealed that 4% of the students considered this method as excellent, 64% as good and the rest as average. None reported their own learning as low or dissatisfactory. As per the effectiveness of the game in the academic achievement of students, the average score of students was9.80 in Intervention group and 7.45 in control group which was statistically significant (Shakor et. al., 2013).

Khalila's study examines the simulation in nursing education and assesses the results of the first clinical practice of students along with simulations in 2014. In this study, 61 sophomore

nursing students of undergraduate students participated. The tool for examining the satisfaction was a self-administered questionnaire of 6 items with Likert score of 5 points. After obtaining consent, students were given a pre-test questionnaire. Two months later, students participated in three simulation training sessions. Simulation scenarios included chest pain, asthma and pneumonia, or post-operative evaluation developed by the instructors. After the end of the sessions, the students were asked to complete the post-test questionnaire. The results showed that the average satisfaction score of students after the intervention increased. The results of this study were similar to ours (Khalaila,2014).

In the study by Najafi et. al., which was conducted on the attitude of Tabriz University of medical sciences students towards the use of computer simulation in education in 2011, 30 Ph.D. students of Tabriz University of Medical Sciences who took the Pharmacology unit in 2007-2008 participated in the study. Some parts of the course was taught with computer simulation software. The results showed that the training of the relevant parts of the pharmacology course which was done using simulation software, had a remarkable satisfaction of over 70 percent of the students (Najafi & Eteraf-Oskouei, 2011). The results of this study were consistent with our study.

A study by Fluharty examined the effect of simulating the care of a dying patient in 2012. 370 nursing students from four faculties of nursing in America were randomly selected to participate in this research. Students in five groups randomly selected one of the role of a nurse, spouse or observer to perform a scenario for 20 minutes. The data collecting tool was a researcher-constructed questionnaire, which was developed according to the Nurse Self-Concept Questionnaire. The results of this study showed that after intervention, the students' confidence and satisfaction scores increased (Fluharty et. al., 2012). The findings of this study are also consistent with our study.

In a study by Alawi and Shariati on 651 staff members of the Tehran University of Medical Sciences, the staff's satisfaction with the e-learning course was studied in 2007. At first, the content of the course was determined by the selected educational committee and then published on a CD. Following up the staff performance in the system was based on their entry into the system and the registering the requested information, including national ID numbers and their personal information. End-of-course tests were given to all occupational groups electronically at the time specified by the personal page of the staff and at computer-equipped places at the university.

After the end of the test, the participants were asked to complete an e-questionnaire related to the determination of staff satisfaction of these courses, which included 17 questions. The content of the questionnaire consisted of staff satisfaction with course content, staff satisfaction with course presentation and satisfaction with e-learning program. The results showed that the staff had a high satisfaction with the training course. The highest average satisfaction was related to satisfaction with the e-learning program (3.96 ± 0.9) out of 5, and the least was satisfaction with the content of the training course (3.84 ± 0.8). (Alavi & Shariati,2010) The results of this study are also in line with our study.

In the meantime, studies have been also conducted that contradict the results of the study. In a study conducted by (Noriyan,2012) titled "Comparison of Two Methods of E-learning and Traditional Dentistry", on PhD dental students of Shahid Beheshti Dentistry School, 70 students of the 11th and 12the semester of Dentistry participated in the study. The students of the Intervention group received the content, which was completely similar to the control group, inhard and audio-visual copies after registration and entry into the system. The control group participated in the traditional classroom held in 17 sessions. Students` satisfaction assessment was done using the standard Individual Development and Educational Assessment (IDEA) questionnaire, which was translated and determined to be valid and reliable. The results showed that the mean and standard deviation of the academic achievement test were similar in both the virtual and traditional education groups and there was no significant difference. Also, students' satisfaction in the two educational groups was not significantly different in the four areas including teacher's capability, educational content, attitude toward the course and the difficulty of the course, and there was a significant difference between the two groups of students in the area of perceived and final judgment of students between the two educational groups (Noriyan,2012).

In the study by (Zulkosky, 2012) that examined the application of simulation in the classroom, impact on knowledge absorption, satisfaction and self-confidence in 2012, 78 nursing students of the fourth semester participated. Then, students were randomly assigned into two groups of Intervention and control. The Intervention group students attended a 4-hour class session and watched and discussed the simulation scenario with which they were trained. In control group, this content was presented in a traditional way using lecture and PowerPoint presentations. According to the findings of the research, the researcher concluded that learners prefer to be trained in the traditional way due to getting used to their passive role. That is why they are not satisfied with simulation training (Zulkosky, 2012). Differences between the results of these two studies and our research may be due to differences in the type and semester of study of a research sample, and the data collection tool was different in our study and other studies.

The study of Hale et. al. In Wichita State University was conducted in 2007 with the aim of assessing students' satisfaction with the Allied Health Pharmacology course held online and in-classroom. The sample of the study included 224 people, 47 of them trained on the Internet and 177 in the classroom in a traditional way. The results showed that the average satisfaction in both groups was estimated to be the same. The results of this study are consistent with the study. who believe that the satisfaction with the virtual method is similar to the traditional one. This is not similar to the results of our studies (Hale et. al., 2009). It seems that the difference results from the difference in the number of samples and the training method in the Intervention group.

On the other hand, our study showed that there was no significant difference between the average satisfaction score among female and male students. Also, the results showed that with increasing age, the satisfaction score increased significantly (correlation coefficient of satisfaction score and age equals 0.26). In a study by (Arrasteh et. al., 2012) titled "Student Satisfaction Survey on the First semester course-based Master students" (Case Study), 270 graduate students were selected by cluster sampling method and were asked to complete a self-administered questionnaire which included 26 questions based on Maryland's Student Satisfaction Study. The results showed a significant relationship between total satisfaction and as the age increases, overall satisfaction increases (Araste & Baniasadi, 2012). There was no significant relationship between demographic information such as gender and marriage. The results of this study were similar to ours.

In a study by (Pournamdar et. al., 2015), titled "Student Satisfaction at the Faculty of Nursing Midwifery with the clinical education status in Zahedan educational hospitals", 142 last semester students attending nursing, operating room and midwifery courses in associate and undergraduate degrees participated. To assess the satisfaction of a clinical condition, satisfaction questionnaire was used whose validity and reliability had been confirmed. The results showed that there is a significant statistical relationship between satisfaction and gender (p = 0.006) (Pournamdar et. al.,2015). The results of this study are not consistent with the results of our study, which seems to be due to differences in sample numbers. According to the studies, and based on the results of our study, it can be concluded that the application of educational aids such as game-based simulation software can enhance the satisfaction level of the students.

5. Conclusion

According to the results, using Appendectomy surgical simulation software (game-based) as a new educational method can be effective in increasing the level of satisfaction of undergraduate students of operating room. Therefore, it is recommended that simulation be used as a supplementary training method for teaching undergraduate students of the operating room. The limitations of this study include the small number of the samples and it is suggested that the subsequent studies should be done by larger number of samples.

References

Abnavi, S.D., Ghadami, A. (2017). Investigating the effect of displaying film before craniotomy surgery on self-efficacy and stress in operating room technology students in isfahan's selected educational hospitals, in 2017.

Alavi, S., Shariati, M. (2010). Investigating employees satisfaction with e-learning courses in tehran university of medical sciences. Iranian journal of medical education, 10(3), 200-210.

Aliafsari, A., Zamanzade, V. (2017). Nursing clinical challenges (review). Journal of medical education development, 10(25), 68-81.

Araste, H., Baniasadi, A. (2012). Student Satisfaction Survey of the First Educational Masters Course : A Case study. Journal of Educational Planning Studies, 1(2), 5-25.

Ashrafsadat, H. (2013). Influential components on nursing students satisfaction in field of study. Journal of nursing education, 2(2), 20-10.

Assadi, S., Shariati, A., Haghighi, S., Latifi, S.M., Sheini-Jaberi, P. (2014). Effects of clinical education and evaluation with portfolio method on nursing students' satisfaction: a clinical trial. Journal of clinical nursing and midwifery, 3(3), 70-79.

Del Blanco, Á., Torrente, J., Fernández-Manjón, B., Ruiz, P., Giner, M. (2017). Using a videogame to facilitate nursing and medical students' first visit to the operating theatre. A randomized controlled trial. Nurse education today, 55, 45-53.

Duers, L.E., Brown, N. (2009). An exploration of student nurses' experiences of formative assessment. Nurse education today, 29(6), 654-659.

Entezari, N., Taleepasand, S., Rezae, A. (2013). The Impact of Static Images and Animation on Learning Improvement: The Moderating Role of Visual Cues and Gender .Journal of Learning and Learning, 5(1), 23-49.

Faraji, A., Khankeh, H., Hosseini, M., Abdi, K., Rezasoltani, P. (2013). Effect of simulated training course on preparedness of nurses to do pre-hospital triage. Journal of health promotion management, 2(4), 24-29.

Fluharty, L., Hayes, A.S., Milgrom, L., Malarney, K., Smith, D., Reklau, M.A. (2012). A multisite, multi–academic track evaluation of end-of-life simulation for nursing education. Clinical simulation in nursing, 8(4), 35-43.

Hale, L.S., Mirakian, E.A., Day, D.B. (2009). Online vs. Classroom instruction: student satisfaction and learning outcomes in an undergraduate allied health pharmacology course. Journal of allied health, 38(2), 36-42.

Henderson, A., Briggs, J., Schoonbeek, S., Paterson, K. (2011). A framework to develop a clinical learning culture in health facilities: ideas from the literature. International nursing review,58(2), 196-202.

Hosseini, M., Irajpour, A., Hayrabedian, A., Khusravi, M., Rarani, S., Ghadami, A. (2017). A study of the views of bachelor students in operating room on evaluation of clinical performance using paper logbook, isfahan university of medical sciences. Annals of tropical medicine and public health, 10(6), 1668-1672.

Karimimonghi, H.,Rad, M.,Bakhshi, M. (2013). Are new teaching methods effective in iranian medical education? A systematic review. Journal of the steps in development of medical education, 10(2), 153-162.

Khalaila, R. (2014). Simulation in nursing education: an evaluation of students' outcomes at their first clinical practice combined with simulations. Nurse education today, 34(2), 252-8.

Khoobi, M., Ahmadi Hedayat, M., Mohamadi, N., Parvizi, S., Haghani, H., Izadibidani, F. (2015). A comparison of nursing students' satisfaction in compact disc-based education vs. Traditional education. Iranian journal of medical education, 15(0), 89-97.

Koh, C., Tan, H.S., Tan, K.C., Fang, L., Fong, F.M., Kan, D. (2010). Investigating the effect of 3d simulation based learning on the motivation and performance of engineering students. Journal of engineering education, 99(3), 237-251.

Najafi, M., Eteraf-Oskouei, T. (2011). Pharmacy students' attitude in tabriz university of medical sciences toward using computerized simulations in teaching. Iranian journal of medical education, 11(4), 308-317.

Noriyan, A.D., Noriyan, A.L., Ebnahmadi, A., Akbarzade, A., Khoshnevisan, M. (2012). Comparison of both virtual and traditional teaching methods in the teaching of theoretical community-oriented dentistry for ph.d. Students of shahid beheshti dental school in 2010-2011. Journal of dental school shahid beheshti university of medical science, 30(3), 174-183.

Pournamdar, Z., Salehiniya, H., Shahrakipoor, M., sohrabzade, S. (2015). Nurse and Midwifery Students' Satisfaction of Clinical Education in Hospitals of Zahedan. Research in Medical Education, 7(2), 45-51.

Ricketts, B. (2011). The role of simulation for learning within pre-registration nursing education—a literature review. Nurse education today, 31(7), 650-654.

Rikhotso, S.R., Williams, M.J.S. (2014). De Wet G. Student nurses' perceptions of guidance and support in rural hospitals. Curationis, 37, 1-6.

Roghani, P.S., Akbarsharifi, T., Ruzbeh, F., Shekarabi, R., Haghani, H. (2006). A study of senior nursing student's opinions about clinical skills level acquired during nursing training. Iran journal of nursing,18(44), 67-76.

Sabri, H., Cowan, B., Kapralos, B., Porte, M., Backstein, D., Dubrowskie, A. (2010). Serious games for knee replacement surgery procedure education and training. Procedia-social and behavioral sciences,2(2), 3483-3488.

Shakor, M., Haghani, F., Shokri, T., Bahramiyan, H. (2013). Effect of game teaching method on student satisfaction and their academic achievement in anatomy lesson. Journal of Isfahan Medical School, 31(244), 1038-1047.

Wilford, A., Doyle, T.J. (2006). Integrating simulation training into the nursing curriculum. British journal of nursing, 15(17), 926-930.

Xiao, D., Jakimowicz, J.J., Albayrak, A., Buzink, S.N., Botden, S.M., Goossens, R.H. (2014). Face, content, and construct validity of a novel portable ergonomic simulator for basic laparoscopic skills. Journal of surgical education, 71(1), 65-72.

Zaribaf, M., Mokhtariyan, M., Lajevardi, M. (2013). Identifying and prioritizing the factors affecting students' satisfaction with the services provided by the university using the kano model (case study: islamic azad university of firoozkooh branch). Journal of industrial strategic management, 9(28), 57-71.

Zulkosky, K.D. (2012). Simulation use in the classroom: impact on knowledge acquisition, satisfaction, and self-confidence. Clinical simulation in nursing, 8(1), 25-33.