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The effect of multi-media educational software on learning basic principles of Cardio-Pulmonary Resuscitation (CPR) in Nursing Students

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ABSTRACT

Aims: Lack of facilities, experienced teachers and choosing appropriate teaching method have always been among the challenges of holding CPR courses. The aim of this study was determining "the effect of multi-media educational software on learning basic principles of Cardio-Pulmonary Resuscitation (CPR) in nursing students".

Methods: This is a quasi-experimental study which was conducted in 2013. The study population included 70 nursing students in fifth and sixth semester of Islamic Azad University of Karaj. The samples were divided into two lecture and practical training (35) and multi-media education and practical training (35) groups through blocked random method. After a week, written exam was taken from the both groups by using basic life support skills questionnaire and after two weeks, practical test was taken based on the standard checklist and also Objective Station Clinical Evaluation (OSCE). Data was analyzed in SPSS 18 software by using independent t-test, chi-square and Mann-Whitney U.

Results: The knowledge mean score in the intervention group (16.20±2.02) was significantly higher than the control group (12.57±2.60) ($p<0.001$). In the scope of practice, there was no significant statistical difference between the two groups in the practical areas of patient's assessment ($p=0.056$), opening the airway and respiration ($p=0.13$) and cardiac massage ($p=0.36$).

Conclusions: The results of the present study indicated that providing content in the form of multimedia software can improve nursing student's knowledge more than lecturing and simulation, but it is not effective in improving students' psychomotor performance. Therefore, using objective methods and clinical education are recommended for improving CPR psychomotor skills.

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1. Introduction

Cardiopulmonary arrest is one of the most important causes of death in developing and developed countries. Annually one million people lose their lives in USA and Europe because of cardiopulmonary arrest; this number is equal to one person per 30 seconds [1]. Studies show that rapid and correct starting of CPR had positive effect on its outcome [2], and increases survivors' chance of survival and quality of life [3]. The level of success in performing CPR is in direct relationship with education. Not only increase of CPR education quantity, but also its quality and achieving skills in higher levels of learning are considered [4]. Shirley et al. (2008) believed that increasing nursing students' skill in performing CPR depends on the amount of education that they receive, so that students with higher quality of educations performed this technique with higher efficacy [5].

Education is a process that results in knowledge and skill, ability in decision-making, performance and change of behavior in learner. Education will be done directly and distantly. Lecturing is one of the direct education methods which is done verbally and is cheap and available and there is the possibility of two-way communication, questioning and answering and getting feedback [6]. Unfortunately, training basic principles of CPR skills requires extensive financial and organizational resources and traditional methods of education can only answer a small part of the society [7].

Nowadays, education methods and tools are changed due to development of information technology and penetration of math media into the society, so that modern methods and tools are provided for transferring knowledge [8]. One of the modern methods of valuable and effective education in the 21st century is electronic education [9]. Electronic education is provided through electronic media, web, organized networks such as; Extranet, Internet, satellite, disc, audio tapes (DVD and CD), multi-media software, virtual education, distant education and computer simulation models [10].

Multi-media education is one of the electronic education types. The word: multi-media is stated from 1950. In this kind of education, it has been tried to provide interaction, creativity and relationship between the user and software through multi-media combination and possibility of advancement [11]. Multi-media educational contents are provided through using transmission of sound, image and text. The quality of providing educational course will be reached to its highest level through two-way communication between the teacher and the learners [10]. The aim of using multi-media education tools is increasing power of decision-making and clinical skills of the students [12]. Among the benefits of using multi-media method in educational situations, it can be pointed out to using multiple senses for learning, more practice to achieve mastery, facilitating participation for creating relationship between the concepts, facilitating repetition of the lesson for reapplication, affordability and flexibility of the program for the learners' need [4]. This educational method completes traditional educational methods and sometimes it answers educational needs alone [13].

A literature review of some studies showed that education by multi-media software is more effective than other methods. In the study of Ertel and Christ (2007) it has been shown that setting up educational software on patients' handheld computer increase their initial cares quality [14]. In the study of Moradi et al. (2010), learning scores of nursing in nuclear cares by using multimedia software was higher in three levels of knowledge, application and understanding [15]. Study of Daneshmandi et al. (2011) with the title of the effect of self-relief and other-relief education through lecturing method and multi-media software pack on the level of personnel's performance showed that education through multimedia method is more effective than lecturing method [16].

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In the study of Vahabi et al. (2011) it has been pointed out to the sameness of education efficacy by software packs with other methods; so that efficacy of two lecturing and multiple-media software was the same on learning triage [17].

Nurses are one of the important members of CPR team and most often they are the first people who are present at the patient's bedside at the time of cardiopulmonary arrest. One of the causes of successful CPR is the level of awareness and performance of CPR performers. More knowledge of the nurses regarding CPR during their education will result in more preparation of them, but mostly CPR lessons are presented theoretically at nursing colleges and nurses' awareness and skill depend on their interest. Lack of facilities and mannequin, large numbers of students, experienced teachers and choosing appropriate education method have always been among the challenges of holding CPR courses. Therefore, identifying attractive and appropriate education methods for better learning in order to achieve CPR knowledge and skill have always been taken into consideration. Considering the benefits of using multi-media education method in education, the researcher decided to conduct a study with the aim of determining the effect of using multi-media educational software on learning basic principles of CPR in nursing students.

2. Methods

It is a quasi-experimental study which was done in 2013. This study compared the effect of educating basic life support skills by multi-media software and class lecturing. Study population included nursing students in fifth and sixth semester of Islamic Azad university of Karaj branch. Sample size was calculated about seventy people by using Nomogram Altman with the power of 80% and standard difference of 2.4 [18]. Samples were divided into two intervention and control groups (each 35) through block random method. Inclusion criteria included: lack of participation in CPR courses before, passing theoretical units of two cardiovascular and emergency lessons and the tendency to participate in the study.

Firstly, CPR educational content was extracted from valid books and clinical guides and during a broad librarian study; its validity was confirmed through content validity method and experts' opinion. Education content was the same in both groups and it was provided based on educational aims of CPR lesson [19].

Firstly required pictures and animations were provided by using **Macromedia, Flash** and **Adobe Photoshop** software to make the software. **Camtasia Studio** and **Multimedia Bulider** software were used for designing pages and framing them. CPR multi-media software included; study guide, content, educational movie, treatment process and some interactional cases and questions, it means that there was a feedback for students' answers to the content questions. Finally the program was given to all the experts for reviewing and correction and then it was given in the form of a CD to the students of intervention group.

Education in lecture group was two four-hour sessions in the classroom and education with software was also two four-hour sessions in the computer room. After the end of the session, CPR multi-media software CD was given to the intervention group and it was asked the students to not give the CD to the other students until the end of the study. Practical education of both groups was done similarly during two sessions in the skill lab by working on the mannequin. Theoretical test was taken from the two groups after one week and OSCE practical test was taken after two weeks.

Data collection tools consisted of two parts. The first part was a questionnaire including demographic features and the second part was a questionnaire including evaluation of students' theoretical knowledge regarding basic life support skills including twenty multiple-choice questions in two levels of learning cognitive area of knowledge and understanding which was provided by Adib Haj-Bagheri (2013) based on CPR guide of America Heart Association. Scores range of the students'

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theoretical knowledge questionnaire regarding basic life support skills was from zero to twenty which was categorized according to the usual scoring pattern of knowledge tests; above 17: very good, 14 to 17: good, 10 to 14: weak and less than 10: very weak. Validity of this questionnaire was confirmed in the study of Adib-e Haj-Bagheri (2013) and its reliability was achieved α=0.87 by calculating cronbach's alpha [20].

Standard checklist designed by Adib-e Haj-Bagheri (2013) and OSCE were used for evaluating students' performance in terms of basic CPR. Performance checklist included three parts; every part was related to one station and number of the questions was from 5 to 9 ones. These checklist were used in the previous articles and their validity and reliability were tested before [15]. Evaluators evaluated the students by observing practical activity (score: one) and lack of practical activity on the mannequin (score: zero) and finally scores related to every part were calculated out of 100. Validity of standard checklist was determined through content validity and also its reliability was determined by inter-scorers method and it was determined score to at least twenty samples. The level of correlation between the two evaluators regarding checklist of the first station was r=0.9, for the second station was r=0.85 and for the third station, it was r=0.88. Correlation coefficient of these checklists was achieved r=0.79 to r=0.91[20].

In this study, the questionnaire was given to some of the faculty members of and specialists of university for determining content validity of the students' theoretical knowledge questionnaire regarding the basic life support skills and it was used after corrections and reviewing. Retest method was used for determining reliability of the questionnaire; for this purpose the questionnaires were given to 11 nurses during two stages with 10 days interval and the correlation of the two tests was r=0.91.

Ethical considerations were considered by achieving permission from the university for entering the study environment, researcher's introduction to the authorities of the research environment and also to the subjects of the study, explaining the aim of the study to the subjects of the study, maintaining subjects' independency by reassuring them that they are free for participating or not participating or stopping participation, reassuring the subjects of the study that data analysis will be done anonymously, reassuring the subjects of the study regarding confidentiality of the information given by them, allowing the students whether to explain their information or not, respecting human dignity of the subjects of the study, reassuring the subjects of the study and the employers working in the research environment that they have free access to the findings of the study if they like.

After collecting information, data were coded and entered into computer. Data were analyzed by $SPSS_{18}$ statistical software after being certain about data correct entrance. In this study, Kolmogorov-Smirnov test was used to determine normality of the data. Normal data analysis was done by using parametric test like independent t-test and abnormal data was analyzed by using non-parametric tests, chi-square and Mann-Whitney U. significant level was considered less than 0.05 in this study.

3. Results

According to the results of the independent t-test, there was no significant difference between the mean of age and mean score of the two control and intervention groups and the two groups were similar in terms of age and mean score (p>0.05) (table 1).

Table 1: Demographic features of the subjects of the study

Group / Variable	Control group Mean±standard deviation	Intervention group Mean±standard deviation	Independent t-test
Age	22.75±2.03	22.22±0.97	0.37 =p -0.9=T
Score mean	51.69±1.47	61.01±1.55	0.7=p 0.38=T

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Results of table 2 showed that there was no statistical significant difference between the two groups in terms of watching CPR and they were homogeneous. As it can be seen in table 3, the mean of knowledge score in intervention group was remarkably higher than control group ($p<0.001$). in reviewing performance, although the score mean of the students' performance in terms of opening the airway, respiration and cardiac massage was higher to some extent, there was no statistical significant difference between the two groups regarding practical area of evaluating the patient, opening airway and respiration and cardiac massage ($p>0.05$).

4. Discussion

In this study, efforts have been made to assess the effect of modern methods on learning CPR basic principles in nursing students. There are three levels of knowledge, understanding and application in the cognitive area. Knowledge is the lowest level of learning in cognitive area and it means that the learner is able to provide some witnesses and to remember the events that she/he has experienced during education through reminding.

Awareness is the ability to find out the concept of something and explaining that concept her/his words. Performance is the ability of applying scientific principles, theses, theorems and other abstract concepts in appropriate situation without providing any solution [6].

Results of the present study showed that using multi-media software increases students' knowledge in terms of basic life support skills more than traditional method. This finding was in consistent with the study of Moradi et al. (2010) regarding effectiveness of multi-media software on nurses' learning levels. In this study, cognitive learning levels including knowledge, understanding, and application were assessed in three stages: before, immediately after and four weeks after education. Results of this study showed that multi-media software can promote learners' understanding in three levels of knowledge, performance, and application [15]. The tools of this study were knowledge and performance, but knowledge was not divided into different areas. Considering designing questions in different levels of cognitive area, increase of knowledge on the whole can show increase of knowledge in all the levels of cognitive area which is in consistent with the results of the study of Moradi (2010). Study of Yamada et al. (1999) was one of the first studies regarding the effect of multi-media software on CPR. In this study, information in resuscitation educational guide was provided in the form of a multi-media software and then nurses' knowledge and attitude towards CPR were assessed in two stages. Results showed that multi-media method caused more increase of knowledge and attitude which is in consistent with the findings of the present study. But there was no difference in the two groups in the follow-up stage that was one month later [21]. In our study, knowledge and performance were assessed instead of knowledge and attitude. Difference in the population of the study and education methods makes it difficult to compare. But assessing the effect of long-term education can be recommended in the future studies. Ertel et al. (2007) conducted a study with the aim of answering this question that whether it is possible to provide informational needs of a person in an emergency situation through a software installed on digital devices or not. The educational software was installed on a handheld computer with internet search technology in the form of audio and video and

Table 2: Assessing subjects of the study regarding the experience of observing CPR

Variable \ Group		Control group		Intervention group		Total		Significant level	Ch-square statistical test
		N	P	N	P	N	P		
Experience of observing CPR	Yes	21	60	27	77.1	48	68.6	0.06=P	2.38

N= Number & P=Percent

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along with interactive technology. Total principles of step by step guide system were provided through algorithms based on the checklist. Results showed that the installed software on the handheld computer could provide required information for performing basic life support skills [14]. One of the advantages of the mentioned research was interactive education and simultaneous use of internet and search by the person himself/herself.

But this finding was not in consistent with the findings of Alijan-Pour et al. (2014) which showed that using only multi-media method does not influence students' awareness level regarding advanced life support skills [4]. Also study of Siavash Vahabi et al. (2011) with the aim of comparing the effect of lecturing and multi-media software on the ability of doing triage in nurses of Isfahan showed that knowledge has been increased after education in lecturing method [17]. Although difference in the target population can be one of the reasons, the main difference is in type of providing and lack of interaction of the software and also the possibility of only one time provide in this method. Probably the possibility of interaction and answering questions in the lecturing method especially in terms of new and complicated issues made it possible to be more effective regarding understanding and learning in compare with multi-media method. In the present study, multi-media software was available for the students to use at any time. Multi-media methods are usually popular among the students to a high extent and they are counted as education creative strategies. Multi-media methods made it possible to consider broader goals regarding solving problems, also it can be better by considering more complicated areas in the curriculum [22]. This method in addition to improving knowledge can also strengthen information in the long-term memory [23]. So it seems that multi-media software is useful and effective for increasing awareness and knowledge level regarding resuscitation.

Proficiency in the CPR skills is very important. If CPR is not performed well due to too much of ventilation, stopping cardiac massage, low rate, and inappropriate depth of chest it leads to decrease in cardiac output and decrease of coronary perfusion pressure and inappropriate outcomes [24]. Our current need is increasing quality of CPR education and achieving skills in higher levels besides increasing quantity of CPR educations. A good education method should be used for increasing quality of education [4]. Results of the present study showed that in terms of performance; multi-media software can be effective in educating practical skills as much as traditional method. This finding is in consistent with the findings of Alijan-Pour et al. (2014) which showed that multi-media method does not influence students' performance level alone regarding advanced life support skills in compare with clinical education [4]. Daneshmandi et al. (2011) evaluated the effect of self-relief and other-relief education with lecturing method and multi-media software pack on the level of performance of military personnel. It was a semi-experimental and an only after single-test. In the lecturing group, providing content was done in the form of lecture for 8 hours. In the multi-media group, multi-media CD containing

Table 3: Mean and standard deviation of the knowledge and performance scores and comparing them in the two groups

Variable \ Group	Control group mean±standard deviation	Intervention group mean±standard deviation	Significant level	Mann-Whitney U test
Knowledge	21.75±2.60	61.02±2.02	p<0.001	-5.288
Patient's evaluation performance	89.82±5.68	49.82±10.37	p=0.056	-1.914
Opening airway and respiration performance	87.63±18.45	58.03±20.04	p=0.13	-1.911
Cardiac massage performance	78.16±9.63	88.88±12.34	p=036	-0.906

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education was given to the participants. OSCE was used for evaluating learners' ability. Results showed that multimedia teaching aids can be effective in the case of appropriate conditions in terms of time and place [16]. This study was focusing on practical skills; it showed that education with multi-media method can cause more improvement in people's performance in addition to its benefit for increasing knowledge in compare with traditional methods.

Study of Delasoura et al. (2010) was done for comparing effectiveness of three methods of CPR education. There was a thirty-minute review through lecturing in the simulation group. For the other three hours the students performed ten simulations by simulator under the observation of the teacher. The second group used multi-media software and tools such as game and questions related to the cases. The third group studied educational materials such as books and special cards for three hours. Students have been evaluated in three stages of pre-test (before intervention), post-test (immediately after intervention) and another post-test (three weeks after education). This study showed that using multi-media software is more effective than individual study and traditional methods [25].

It seems that multi-media educational method is reliable for increasing knowledge and promoting theoretical skills, but it is not useful alone for educating practical skills. Although multi-media methods were recommended for teaching nursing skills many years ago, it was not considered a lot so far [26]. Most of the studies in this regard are mainly focused on knowledge and attitude. Perhaps the reason is that it is easier to cover educational contents related to these two areas in compare with psychomotor area. Also evaluating these two areas need less facilities. Life support skills need achieving skills in some maneuver such as opening airway, cardiac massage and evaluating the patient; probably direct education is more effective for their learning. It seems that the best strategy for achieving the two aims of cognitive and psychomotor areas is using a combination of educational methods; for example multimedia software along with practical, tangible and concrete education.

5. Conclusions

Lack of facilities, experienced teachers and choosing an appropriate education method have always been among the challenges of holding CPR courses. Results of the present study showed that providing content in the form of multi-media software can increase nursing students' knowledge more than lecturing and simulating, but it is not effective in improving students' psychomotor skills. Therefore using OSCE methods are recommended for improving CPR psychomotor skills.

Among the limitations of the presents study, it can be pointed out to impossibility of before and after comparing of knowledge and performance in both groups. Since the students did not receive any education about CPR before and it was in their curriculum, holding pretest did not have special results. Pretest can be done if this course is held for the group of the nurses that are working or those who have passed this course before. Another limitation of the study was lack of following up and test in the next stages for assessing the level of education survival. It is recommended to conduct other studies regarding comparison of the effect of multi-media software with distance education method on nursing students' CPR skills, also assessing the effect of different methods of education specially smartphones software on nursing students' CPR knowledge and skills.

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