VIA MEDICA

ORIGINAL ARTICLE

Disaster and Emergency Medicine Journal
2022, Vol. 7, No. 2, 83–89
DOI: 10.5603/DEMJ.a2022.0014

ISSN 2451–4691, e-ISSN 2543–5957

A COMPARATIVE STUDY ON EFFECTIVENESS OF WORKSHOP EDUCATION VERSUS EDUCATION VIA MOBILE LEARNING (M-LEARNING) IN DEVELOPING MEDICAL STUDENTS' KNOWLEDGE AND SKILL ABOUT CARDIOPULMONARY RESUSCITATION

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ABSTRACT

INTRODUCTION: A variety of educational approaches are being used today to improve learning in the field of cardiopulmonary resuscitation. Therefore, the present study was conducted to compare workshop education with education via mobile learning (M-learning) in terms of their efficacy in developing medical students' knowledge and skills about cardiopulmonary resuscitation.

MATERIAL AND METHODS: The present study was quasi-experimental performed on 60 interns selected from a university of medical sciences in southwest Iran. Participants were assigned to either the workshop education group (n = 30) or the mobile learning group (n = 30). Before and after the intervention, the knowledge and skills of the participants in terms of basic and advanced cardiopulmonary resuscitation were measured by a questionnaire. The collected data were analyzed using descriptive statistics, Independent-Samples t-Test, Paired-Samples t-Test, and Chi-Square Test in SPSS software v. 22.

RESULTS: Education via mobile learning caused a significant increase in the participants' knowledge about cardiopulmonary resuscitation ($p < 0.05$). However, this method did not result in a significant difference in the participants' skill scores, while the workshop education group showed a significant increase in their cardiopulmonary resuscitation skill scores ($p < 0.05$).

CONCLUSIONS: Our results revealed that education via mobile learning was better in enhancing medical students' knowledge about cardiopulmonary resuscitation. However, workshop education was more effective in developing practical skills in the field of cardiopulmonary resuscitation. Accordingly, educators are recommended to employ a combination of mobile learning and workshop education for achieving better results.

KEY WORDS: cardiopulmonary resuscitation; medical students; education; mobile learning

Disaster Emerg Med J 2022; 7(2): 83–89

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Received: 22.01.2022 Accepted: 18.04.2022 Early publication date: 24.06.2022

INTRODUCTION

The manner of performing cardiopulmonary resuscitation (CPR) determines its chances of success in reviving the patient [1]. Effective medical procedures must be implemented as quickly as possible in the case of a cardiopulmonary arrest. In managing a patient who has had a cardiopulmonary arrest, time is of crucial importance so that, every minute of delay in beginning the treatment reduces the patient's chances of survival by 10% [2–3]. Medical students and other members of healthcare teams must be able to diagnose a cardiopulmonary arrest immediately and take the necessary measures in the shortest time possible. Therefore, it is essential for the medical students and healthcare teams to have sufficient knowledge and skill in cardiopulmonary resuscitation [4–5]. Success in cardiopulmonary resuscitation is strongly correlated with education [6]. Knowledge and skill of the medical professionals in the field of cardiopulmonary resuscitation can increase chances of success and reduce mortality rates and adverse consequences related to resuscitation [7–8]. Today, medical education is accompanied by many complications in theoretical and clinical environments, providing the policymakers and educators with obstacles on their way to preparing medical students for entrance to the healthcare system. Some of these obstacles may be overcome using new educational approaches [9–10]. Information and communication technologies have inevitably transformed the teaching-learning process. Education via mobile learning (M-learning) is one of the technology-based methods of presenting information [11–12].

Mobile learning has many features; one of the major features is that mobile devices are the places to share knowledge. A wide variety of users and shared knowledge exist in mobile devices, thus they have a significant role as tools to improve education [13].

Students' great interest in mobile devices has drawn the attention of the educators to the use of this method in medical education [14]. Simply, the main advantage of mobile learning is its access. Mobile devices enable the students to learn at any time or location-whenever and wherever it suits them. Another added value associated with mobile learning is that it presents more situated and contextual learning [15].

With the outbreak of coronavirus disease 2019 (COVID-19) and the closure of educational centers due to the risk of disease transmission, the use of virtual training methods (for example, mobile learning) in educational centers is increasing and this educational method has an important and effective role in solving the challenges related to having face-to-face classes during the COVID-19 pandemic [16].

Therefore, given the increase in the popularity of mobile learning and its application in medical education, the present study is carried out to compare workshop education with education via mobile learning regarding their efficacy in developing medical students' knowledge and skills about cardiopulmonary resuscitation.

MATERIAL AND METHODS

The present study was quasi-experimental and conducted in 2019. The study population included 7th-year medical students (interns) selected from the Fasa University of Medical Sciences (Fasa county, Fars province, in southwest Iran). Sampling was done according to the census method and the participants were randomly allocated to the workshop education group (n = 30) and mobile learning group (n = 30). Inclusion criteria were being a 7th-year medical student and willingness to participate in the study (signing an informed written consent). Exclusion criteria were failure to complete the questionnaire or partial completion of the questionnaire and not being physically or emotionally prepared to cooperate due to fatigue from work and not being in a CPR workshop at the time of the study.

The training was administered in 3 two-hour sessions totally lasted for 6 hours in both training methods. The mobile learning group received education through 3 two-hour sessions totally lasted for 6 hours via Telegram messenger for 2 weeks. Educational materials concerning cardiopulmonary resuscitation were provided continuously and daily through a channel in Telegram messenger, in the form of photos, videos, and texts. Video clips and images were used to improve skills regarding cardiac massage and tracheal intubation as well as skills in using a defibrillator in the mobile learning method. Moreover, a cardiologist provided the necessary explanations on the images and educational video clips for a better understanding of the content.

The data collection tool used in the present study was a questionnaire consisting of four parts: personal information, basic life support (BLS) practice test, the advanced cardiovascular life support (ACLS)

test, and a test for cardiopulmonary resuscitation skills. The section on personal information included four questions about age, gender, the experience of theoretical and practical training in the field of resuscitation, and experience of attending a CPR workshop. The knowledge test is a standard scale developed based on the CPR guidelines of the American Heart Association (AHA). Adib et al. [17], in a study, tested the psychometric properties of the scale and reported it to have adequate validity and reliability. The Cronbach's alpha of the scale was found to be 0.87. In the present study, the test-retest reliability of the scale was measured among 50 medical students within a 2-week interval. The value of Cronbach's alpha was found to be 0.89. The knowledge test consisted of 40 multiple-choice questions (21 questions on basic resuscitation and 19 questions on advanced resuscitation). Each question had one correct and three incorrect answers. Correct answers were scored one, and incorrect ones were scored zero. Knowledge scores ranged from 0–40. Scores were graded according to the scale for academic grades: a score of under 20 (under 50% of the total score) was regarded as weak; scores ranging from 20–28 (50–70% of the total score) were regarded as average; scores ranging between 29–34 (71–85% of the total score) were regarded as satisfactory; and scores of 35 and above (86% and above the total score) were regarded as excellent. The checklist of cardiac massage skills consisted of 20 items, which were answered on a yes/no basis so that, a yes answer was scored one, and a no answer was scored zero. The checklist of defibrillation skills by direct current (DC) shock consisted of 15 items, which were answered on a yes/no basis so that, a yes answer was scored one, and a no answer was scored zero. The checklist of tracheal intubation skills consisted of 14 items, which were answered on a yes/no basis so that, a yes answer was scored one, and a no answer was scored zero. The knowledge questionnaire and skills checklists were completed by both study groups once before the intervention and again 2 weeks after the intervention. For analyzing the data, descriptive statistics, Paired-Samples t-Test, Independent-Samples t-Test, and Chi-Square tests were used. The collected data were analyzed using SPSS software (Version 22, IBM Corporation, Armonk, New York). The significance level was set at $p < 0.05$.

Ethical considerations

Informed written consent was obtained from all the participants before participating in the study. The present study was conducted in accordance with the principles of the revised Declaration of Helsinki, a statement of ethical principles, which directs the physicians and other participants in medical research involving human subjects. The participants were assured of their anonymity and confidentiality of their information Moreover, the study was approved by the local Ethics Committee of Shiraz University of Medical Sciences, Shiraz, Fars province, Iran (Ethics code: IR.S UMS.REC.1396.1070).

RESULTS

Among 60 participants, 36 (60%) of them were female and 24 (40%) of them were male. Mean of their ages was equal to 27.78 ± 1.41 years old. The results of Chi-Square test of the two groups did not differ significantly in terms of demographic characteristics (*i.e.*, age and sex) and level of knowledge and skills about cardiopulmonary resuscitation before the intervention, indicating homogeneity of samples in both groups (Tab. 1). The difference between pre-test and post-test scores of the workshop education group was not significant in basic and advanced knowledge about resuscitation ($p = 0.73$).

Table 1. Demographic characteristics of medical students in the two groups

Variable		Group		p-value
Age 27.55 ± 1.32		Workshop education 26.33 ± 1.39	Mobile learning	0.45
Gender	Female	17 (47.2)	19 (52.7)	0.37
	Male	11 (45.8)	13 (54.1)	
CPR knowledge		Workshop education	Mobile learning	0.730
CPR skill		Workshop education	Mobile learning	0.89

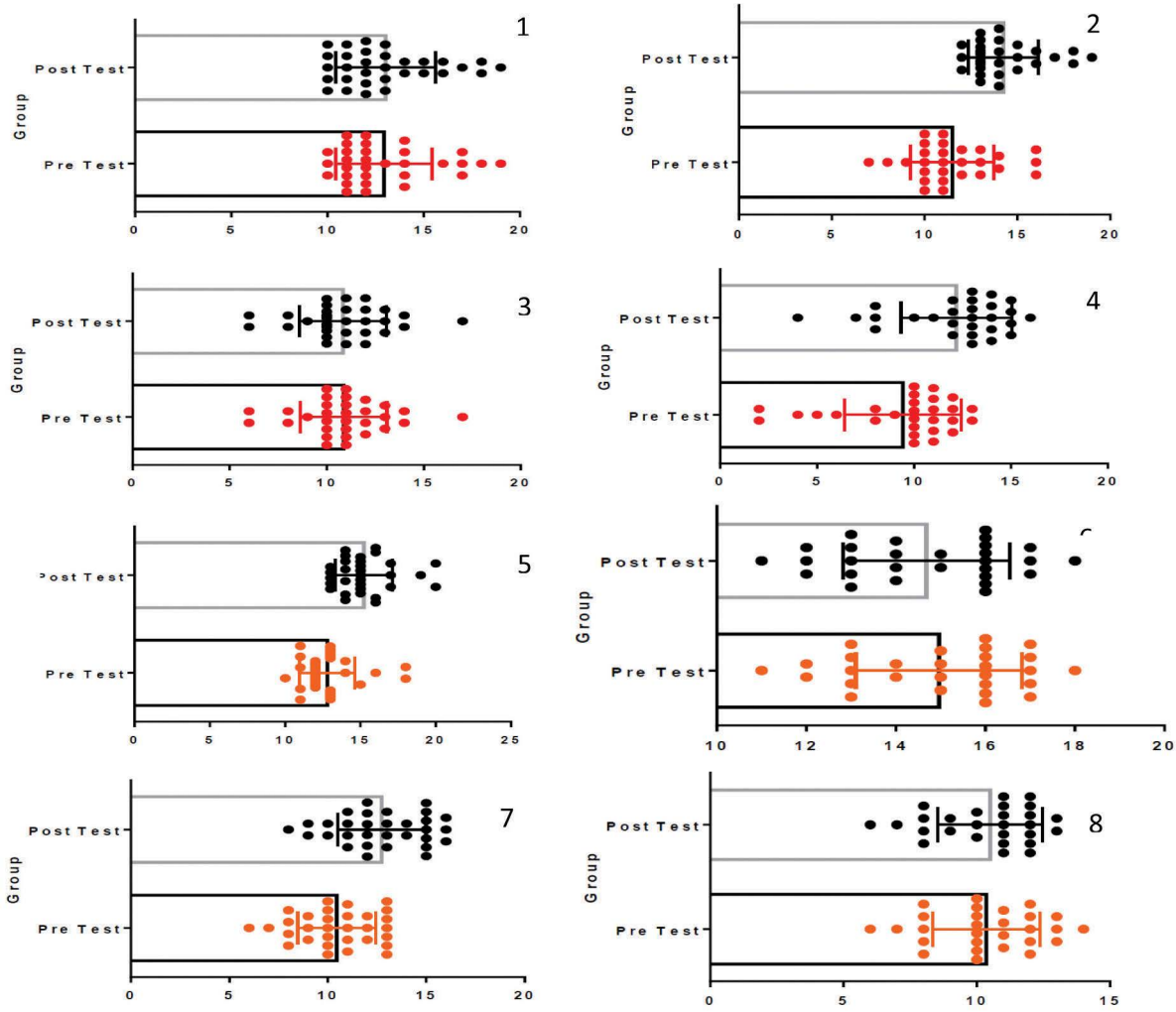

FIGURE 1. **1.** of the frequency of the pretest and posttest scores obtained for: **1.** Basic CPR in the Workshop group; **2.** Basic CPR in the M-Learning group; **3.** Advanced CPR in the Workshop group; **4.** Advanced CPR in the M-Learning group; **5.** Cardiac massage skill in the Workshop group; **6.** Cardiac massage skill in the M-Learning group; **7.** Tracheal intubation skill in the Workshop group; **8.** Tracheal intubation skill in the M-Learning group

However, in the case of the mobile learning group, the difference between pre-test and post-test knowledge scores was significant ($p < 0.05$). Regarding skills in trachea intubation, cardiac massage, and using a defibrillator, the difference between pre--test and post-test scores of the workshop education group was found to be significant ($p < 0.05$). On the other hand, the difference between pre-test and post-test skill scores of the mobile learning group was not significant (Fig. 1, Tab. 2).

DISCUSSION

The present study was conducted to compare education via mobile learning with workshop education in terms of their effectiveness in developing medical interns' knowledge and skills about cardiopulmonary resuscitation. Herein, the mean knowledge score was equal to 23.80 ± 3.76 before the intervention and it was equal to 24.87 ± 3.84 after the intervention in the workshop education group. Despite that, the mean knowledge score was increased, this increase was not significant. On the other hand, the mean knowledge score was equal to 20.92 ± 4.54 before the intervention and it was equal to 26.42 ± 3.98 after the intervention in the mobile learning group and this increase was statistically significant. This finding can be justified by pointing out the fact that educational content is presented in the form of lectures in the workshop education group but it is presented in the form of lectures as well as video clips and images in the mobile learning method. One of the advantages of the mobile learning method is that this method allows

Table 2. The differences between the knowledge scores and skill scores of the students obtained before and after intervention as calculated with paired t-test

Variable	Group	Before intervention		After intervention		p-value
		Mean	SD	Mean	SD	
General knowledge	Workshop education	23.80	3.76	24.87	3.84	0.730
	Mobile learning	20.92	4.54	26.42	3.98	0.025
Basic CPR knowledge	Workshop education	12.94	2.51	13.03	2.58	0.374
	Mobile learning	11.50	2.25	14.25	1.89	0.017
Advanced CPR knowledge	Workshop education	10.87	2.23	10.84	2.25	0.768
	Mobile learning	9.43	3.01	12.18	2.85	0.032
Skill in cardiac massage	Workshop education	12.81	1.85	15.23	1.89	0.028
	Mobile learning	14.96	1.85	14.68	1.86	0.223
Skill in tracheal intubation	Workshop education	10.45	1.98	12.74	2.25	0.037
	Mobile learning	10.36	2.00	11.39	1.97	0.212
Skill in using a defibrillator	Workshop education	11	1.86	12.45	1.92	0.013
	Mobile learning	11.29	2.05	11.39	2.16	0.477
Skill in CPR management	Workshop education	0.68	0.65	0.71	0.73	0.325
	Mobile learning	0.93	0.76	0.96	0.83	0.326
Overall skill	Workshop education	34.96	3.09	41.13	3.37	0.045
	Mobile learning	37.53	4.44	37.5	9.35	0.896

SD — standard deviation; CPR — cardiopulmonary resuscitation

the learners to watch educational content many times without a time limit. In their study, Zia Ziabari et al. [18], investigated the effect of education via social networks on medical students' knowledge of CPR and reported a significant difference between knowledge scores of the intervention and control groups, which is consistent with findings of the present study.

Likewise, Najafi Ghezeljeh et al. [19], investigated the effect of education via Telegram messenger on emergency nurses' preparation for disasters, and they showed a significant difference between the knowledge scores of the nurses in the intervention group before and after education compared to those of the control group, confirming productivity of education via virtual social networks. In their comparative study on virtual and conventional educational approaches with regard to their role in dental students' learning, Moazami et al. [20], concluded that virtual education is more fruitful than conventional education, which is in line with the results of the present study. Similarly, Ahn et al. [21], demonstrated that virtual education increases medical students knowledge of CPR.

Another finding of the present study was that compared to education via cell phones only, workshop education is more effective in developing interns' CPR skills including cardiac massage, intubation, and using a defibrillator, and also the relationship between the participants' pre-test and post-test scores was significant. In their study, Alijanpour et al. [22] and Nord et al. [23] compared practical education with multimedia education in terms of their effectiveness in improving medical students' learning of CPR and concluded that the group which received education through practice combined with theory was more skillful than the group which received education exclusively from a virtual network, which is consistent with findings of the present study.

In their study, Ghorbani et al. [24], showed that the mean score of CPR skills in the workshop group was higher than the WhatsApp messenger group.

According to Moon [25], workshop education combined with mobile learning is effective in developing nursing students' knowledge, skill, and self-efficacy in the field of CPR. Park et al. [26] stated that education via virtual methods alone cannot transfer all the knowledge and experiences of the educators to learners. Thus, it can be concluded that modern educational methods including virtual education, alone cannot be sufficient for training medical professionals, especially in practical areas, such as CPR, which are linked to the patients' lives. If enough practical education is not provided by a trainer in person and correct techniques are not taught effectively, learners' education may not have the necessary efficacy leading to fatal consequences including brain death and loss of patients' lives.

Reder et al. [27], believed that CPR skills are a set of hard psychomotor skills and actions requiring hands-on practice. They argued that computer-assisted training only could be useful for explaining the series of actions needed for CPR skills, not for CPR practices.

Limitations of the study

Limitations of the present study included a small sample size, impossibility of random assignment, and the lack of blinding. In the present study, there was an opportunity for the subjects in the workshop education and mobile learning groups to practice in the same university of medical sciences and therefore, there was a chance for transfer of the educational content. For minimizing the effect of this limitation on the results of the study, the researchers did not inform the subjects about their group assignment. However, the researchers were not able to fully eliminate that possibility.

CONCLUSIONS

Our findings revealed that despite the effectiveness of both methods, workshop education had a better effect on students' performance. Practical education and mobile learning can both be used to teach skills, but it seems that a combination of these approaches can raise students' level of knowledge and facilitate their acquisition of skills. Thus, in schools of medical sciences, educators are recommended to combine workshop education with mobile learning to improve the quality and efficacy of education for the students.

Conflict of Interests

All authors declared no personal or financial conflict of interests

Ethical Approval

The participants willingly filled out the questionnaires and signed written informed consent. The study was approved by the Ethics Committee of Shiraz University of Medical Sciences (code: IR.S UMS. REC.1396.1070).

Authors' contributions

MA, MA, LB, contributed to the conception, and data interpretation. MA, LB, GHV contributed to data collection and statistical analysis. MB, MA, MD contributed to the drafting of the manuscript, and approval of the final version of the manuscript.

Funding/Support

This study was supported by the Research and Technology Deputy of Shiraz University of Medical Sciences.

Acknowledgements

The authors thank the nurses who participated in the study. The authors would like to appreciate the research and technology deputy of Shiraz University of Medical Sciences.

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