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# Comparison the Effect of Basic CPR Face-to-face and Electronic Training on the Self-efficacy of High School Students

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**Original Article**

## Abstract

**INTRODUCTION:** Today, cardiopulmonary resuscitation (CPR) training is highly important to save the lives of people in need of CPR by those present at the scene, and it is useful to study new training tools in this field. This study aimed to determine and compare the effect of basic CPR face-to-face and electronic training on the self-efficacy of high school students.

**METHODS:** This randomized controlled field trial study was conducted on second-grade high school students in Tabas, Iran, referring to high schools by an announced call. The samples (n=62) were randomly selected and divided into two groups of e-learning and face-to-face training (n=31 each). Both groups completed the Basic Resuscitation Skills Self-Efficacy Scale at the baseline and 1 week and 2 months after the training intervention. The collected data were analyzed in SPSS software (version 20) using statistical measures of mean and standard deviation and statistical tests of t-test, Chi-square, and repeated measures analysis of variance.

**FINDINGS:** The results showed that both e-learning and face-to-face training methods significantly increased the self-efficacy of high school students in CPR in 1 week and 2 months after training. In addition, a significant difference was observed between the two methods regarding the mean score of basic CPR self-efficacy 1 week after the intervention (P<0.001).

**CONCLUSION:** Considering the benefits of e-learning on students' CPR learning, this method should be used seriously for basic CPR self-efficacy training.

**Keywords:** Cardiopulmonary Resuscitation; E-learning; Face-to-face Training; Self-efficacy.

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## Introduction

Sudden cardiac arrest is the cause of 60% of deaths among patients with cardiovascular disease. The chance of survival after cardiac arrest in outpatient settings has been reported to be less than 5% (1). Out-of-hospital cardiac arrest is a significant health issue and is associated with very high mortality and morbidity rates (2, 3). According to statistics, 5 million people worldwide suffer from out-of-hospital cardiac arrest annually, among which only 7% would survive (4). Some factors, such as gender, age, race, and nationality, can affect the rate of death due to cardiac arrest (1). However, to improve the outcomes of sudden cardiac arrest, rapid cardiovascular resuscitation, rapid emergency services, early defibrillation, and timely support (2) are essential during cardiopulmonary resuscitation (CPR) and the response time of the medical team (5).

Although the survival of cardiovascular disease has improved significantly over the past 30 years, it seems that the survival of out-of-hospital cardiac arrest will not be increasing globally (4). For this reason, the American Heart Association supported CPR training for people, especially high school students that are an excellent target community for CPR training (6, 7). More than 16 million students in the USA have requested to receive CPR training (8, 9), and

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through CPR training for high school students, the mortality rate of out-of-hospital patients in need of CPR and the absence of specialist access was reduced (10). Therefore, first aid training can be provided to different groups to provide useful human resources who are the first responders at the scene of the accident (11, 12). However, in Iran, there is no written program for teaching CPR to high school students and it is presented in a scattered and occasional manner. Cardiopulmonary resuscitation training is implemented through different methods, such as face-to-face training (e.g., workshop training and direct observation,) and electronic training (e.g., screening videos and simulated situation).

It is noteworthy that face-to-face training is more common; nevertheless, in numerous situations, due to limited resources, equipment, and manpower, it is not possible to implement this method; therefore, it is necessary to use electronic methods (13). In this regard, the findings of a study performed by Roberg et al., examining the two methods of online computer training and classroom training, indicated the advantage of the classroom in the high quality of cardiovascular resuscitation skills (13).

The results of a study conducted by Ahn et al. showed that frequent watching of CPR videos via mobile phone increased the skill and recall length in the studied group (14). One of the most important pieces of training in cardiac resuscitation is self-efficacy (15), which has a direct relationship with optimal performance during CPR. Self-efficacy, one's belief in the ability to perform CPR, is one of the indicators to evaluate the effectiveness of CPR training on actual performance (15). Although some individuals possess adequate knowledge and skill in the field of CPR, they have low self-efficacy that may lead to failure to perform CPR (16). It has been emphasized that self-efficacy in CPR is related to survival. Moreover, the self-efficacy in performing CPR can be attributed to various factors, such as the method of CPR training and quality of training, personal characteristics, cultural sensitivity, and the environment. In addition, it can be said that CPR training is related to practical training and self-efficacy. Therefore, to improve self-efficacy in conducting CPR and CPR training rates and its improvement, the government should expand the provision of training programs to enhance CPR self-efficacy (17). In this respect, it can be expected that by teaching CPR to students, in the event of a problem for a patient in need of immediate CPR, students will be able to help the patient until the emergency team arrives. Nevertheless, at present, numerous witnesses on the scene, including high school students, lack the necessary skills and self-efficacy to resuscitate and they are afraid of dealing with critical situations; as a result, it seems necessary to provide training in this regard. Therefore, this study was conducted to compare the effect of face-to-face and electronic basic CPR training on the self-efficacy of high school students.

## Methods

The statistical population of this randomized controlled field trial study consisted of all high school students (n=630) in Tabas, South Khorasan Province, Iran. The samples were selected using the availability sampling method. The sample size of the present study was determined at 11 individuals in each group based on the results of a study performed by Alimohammadi et al. (18) and considering $S_1 = 2.01$, $S_2 = 2.3$, $\bar{X}_1 = 12.3$, $\bar{X}_2 = 19.1$, $\alpha = 0.05$, $\beta = 0.1$, and $d = 3$ were estimated in 11 people in each group; however, the final sample size in each group was increased to 31 cases to improve accuracy and considering the possibility of drop-out.

$$n = \frac{\left(z_1 - \frac{\alpha}{2} + z_1 - \right)^2 (s_1^2 + s_2^2)}{(\bar{X}_1 - X_2)^2}$$

Initially, the proposal was submitted to and approved by the research center and the university research council, and the code of ethics was obtained. Afterward, the university issued a permit to conduct the study and an introduction letter was issued to the Department of Education in Tabas. In the next step, with the consent of that department, the researcher referred to the studied high schools. With the permission of the high school authorities, the researcher justified the presence of the students' parents before the onset of the educational sessions.

The research importance, objectives, and procedures were explained to all individuals, and they were assured of confidentiality in this study. The informed consent forms were completed by the parents of the participants. Subsequently, the samples were selected using a simple random sampling method. First, the researcher chose all



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the high schools, each with different majors, including mathematics and physics, experiential sciences, literature and humanities, and vocational training, among which, those with the vocational training field were randomly selected. The researcher then selected 4 high schools, including 2 girls' schools and 2 boys' schools, which were randomly divided into two schools for face-to-face education and two schools for e-learning due to the lack of communication between students and the blinding of the study. Afterward, the students were selected from three grades of vocational training schools, namely the tenth, eleventh, and twelfth grades, with 24, 19, and 19 randomly selected cases, respectively. There were 31 individuals in each group of the e-learning and face-to-face education.

In the next step, the Self-Efficacy Scale, developed by Hernández-Padilla, was filled out by the researcher assistant, followed by the training of CPR in face-to-face and electronic methods. Face-to-face training was conducted in the form of face-to-face lectures by the researcher and one of the professors of Tabas School of Nursing, Tabas, Iran, for two consecutive days. To carry out e-learning, educational materials were placed on www. Cpr4students.moodlecloud.com for training and study. The students' self-efficacy was assessed 1 week after and once more 2 months after the training. After the training course, all participating students in the research were appreciated. Education officials were also assured that the results of the study would be made available to them if they so wished.

To conduct this research, according to the guidelines provided by the American Heart Association, an adult-based CPR training course was prepared for high school students in two formats, namely face-to-face teaching and e-learning. It should be noted that the e-learning system used in this research was designed using Moodle platform. It is a popular software system to create online classrooms and has a variety of possibilities for designing the classroom, including defining sessions, creating tests, uploading educational files in various formats, downloading by students, and scheduling sessions. It is noteworthy that the same topics were presented in face-to-face and e-learning.

In the e-learning method, at the end of each topic, students had to answer eight to ten questions and earn a score of 70% or higher to qualify for receiving the next topic. In addition, a short four-minute resuscitation film was used, which was approved by the Mashhad University of Medical Sciences, Mashhad, Iran. Each course was designed in 2 training sessions, in which the concepts of basic CPR were trained at the level for high school students and using a manikin and an automated external defibrillator (AED) for 2 consecutive days by the researcher and instructor of the School of Nursing. This training was free of complex and specialized medical definitions and |understandable for students with high school knowledge levels.

***Data collection tools and methods***

In this study, two questionnaires were used to collect the required data, namely, a demographic information form and the Basic Resuscitation Skills Self-Efficacy Scale developed by Hernández-Padilla.

***Demographic information form***

In this questionnaire, the following demographic information was obtained from the participants: age (year), gender (girl/boy), the field of study (i.e., mathematics and physics, experimental sciences, literature and humanities, vocational training), paternal education (illiterate, middle school, associate, bachelor, and higher), maternal education (illiterate, middle school, associate, bachelor, and higher ), father's job (unemployed, self-employed, civil servant, private sector employee), and mother's job (unemployed, self-employed, civil servant, private sector employee, and housekeeper).

***Basic Resuscitation Skills Self-Efficacy Scale***

To measure self-efficacy, the Basic Resuscitation Skills Self-Efficacy Scale, designed by Hernández-Padilla et al. (2014), was used. The reliability of this questionnaire was confirmed by its developers using Cronbach's alpha (α=0.96). The developers claimed that the questionnaire showed good psychometric properties to measure self-efficacy in the field of basic cardiac resuscitation skills. The evidence gathered by the developers of this scale revealed its appropriate sensitivity and specificity; therefore, they released the questionnaire for general use. This 18-item questionnaire measures the respondents' self-efficacy of cardiac resuscitation and is scored on a 5-point Likert scale (1=strongly disagree, 2=disagree, 3=have no opinion, 4=agree, 5=strongly agree) (19).



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The highest and lowest scores that can be obtained in this questionnaire are 90 and 18, respectively. For translation validity, the translated questionnaire by two language professors of the faculty was distributed among ten nursing instructors of the School of Nursing, Birjand University of Medical Sciences, Birjand, Iran, to examine the content and appearance of the instrument, and their opinions were applied. The reliability of the questionnaire was confirmed by administrating the questionnaire on ten students out of the study and using Cronbach's alpha coefficient (α=86%).

The inclusion criteria were having the informed consent of the student and parents, studying in secondary school, not participating in the previous courses of CPR training or similar courses, lacking physical and motor disabilities, having access to the Internet, having access to a personal computer at home, and parents' not working in healthcare section.

On the other hand, the subjects who withdrew from the study for any reason, were absent from the CPR training course in one session, dropped out during the study period, and failed to visit and work at the training site (i.e.,www.Cpr4students.moodlecloud.com) were excluded from the study.

The collected data were analyzed in SPSS software (version 20) using descriptive statistics (frequency distribution, percentage, mean, and standard deviation) and analytical statistics. After ensuring the normality, the repeated measures ANOVA, Bonferroni post hoc test, and independent t-test were performed. The significance level was considered P< 0.005 for all tests.

All ethical considerations were observed in this study with the code of Ir.bums. REC.1398.141, which was approved on 23 July 2019 in the meeting of the Ethics Committee of Birjand University of Medical Sciences.

## Findings

This study was performed on 62 students in two groups (n=31 each). Based on the results, no statistically significant difference was observed in the mean age and grade point average between face-to-face and e-learning groups. In other words, the two groups were matched in terms of age and grade point average (Table ۲). Moreover, based on the results, there was no statistically significant difference between the two groups in the frequency distribution of gender, paternal education, maternal education, paternal job, maternal job, and the grade in the two groups of face-to-face education and e-learning. In other words, the two groups studied were matched in terms of age (P=0.534), grade point average (P=0.950), gender (P=0.309), paternal education (P=0.756), maternal education (P=0.666), paternal job (P=0.995), maternal job (P=0.609) and the grade (P=0.707).

According to the results, there was a statistically significant difference before the intervention and 1 week after the intervention in the mean score of basic CPR self-efficacy between the e-learning and face-to-face training groups (P=0.046). The mean score of basic CPR self-efficacy before the intervention was higher in the e-learning group than in the face-to-face training group (2.830 vs. 2.563). The mean score of basic CPR self-efficacy 1 week after the intervention was higher in the e-learning group than in the face-to-face training group (4.498 vs. 4.149). Nonetheless, no statistically significant difference was observed 2 months after the intervention in the mean score of CPR self-efficacy between e-learning and face-to-face training groups (Table 3).

**Table 1.** Training sessions

| Session | Content |
|---|---|
| First session | Definition and importance of basic cardiopulmonary resuscitation: 10 minutes<br>Types of death and diagnostic symptoms: 5 minutes<br>Out-of-hospital chain of survival: 5 minutes<br>Importance of golden time: 5 minutes<br>Scene inspection and safety: 5 minutes<br>Examination and diagnosis of a person with cardiac and respiratory arrest: 10 minutes<br>Cardiac massage: 20 minutes |
| Second session | Artificial respiration: 20 minutes<br>Recovery status: 5 minutes<br>Tutorial of AED usage: 30 minutes |

AED: Automatic external defibrillator



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**Table 2.** Comparison of the mean age and grade point average of students in the two groups of face-to-face education and e-learning

| Demographic variable | E-learning (n=31) mean±SD | Face-to-face (n=31) mean±SD | Independent t-test |
|---|---|---|---|
| Age | 16.0±677.832 | 16.0±806.792 | t=-0.625, df=60 P=0.534 |
| Average grade point | 17.1±913.439 | 17.1±934.016 | t=-0.063, df=55 P=0.950 |

**Table 3.** Comparison of the mean self-efficacy of basic cardiopulmonary resuscitation in the two groups

| Study group Time | E-learning (n=31) $\bar{x} \pm SD$ | Face-to-face (n=31) $\bar{x} \pm SD$ | Independent t-test |
|---|---|---|---|
| Before the intervention | 2.0±830.524 | 2.0±563.508 | t=1.60, df=58 P=0.046 |
| One week after the intervention | 4.0±498.271 | 4.0±149.427 | t=0.38, df=58 P<0.001 |
| Two months after the intervention | 3.0±905.638 | 3.0±939.430 | t=2.88, df=58 P=0.739 |
| Repeated measures ANOVA | F=159±956 df=2.60 P<0.001 | F=91.526 df=2.60 P<0.001 | |
| Bonferroni post hoc test | Before the intervention with one week after the intervention P<0.001 | P<0.001 | |
| | Before the intervention with two months after the intervention P<0.001 | P<0.001 | |
| | One week with two months after the intervention P=0.003 | P=0.303 | |

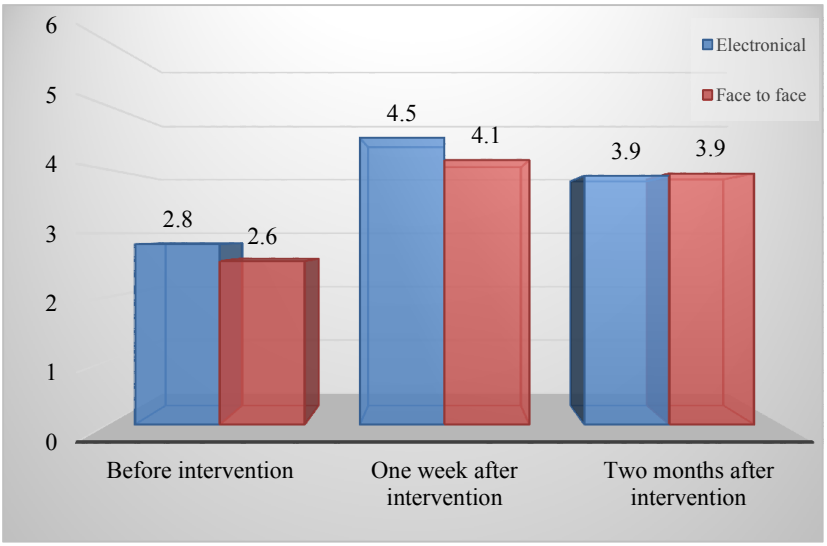



**Figure 1.** Comparison of mean cardiopulmonary resuscitation self-efficacy in the two groups in the three stages of at the baseline and one week and two months after the intervention

## Discussion and Conclusion

This study was performed on 62 high school students to investigate and compare the differences between e-learning and face-to-face teaching techniques in promoting self-efficacy in basic CPR training. The performance of first aid by the knowledgeable people present at the scene



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of the accident can lead to greater survival and less damage to the injured (20). Therefore, training at schools can be a long-term strategy in educating the community in a wider scope on how to manage the injured, which has been shown to be highly effective. Over time, if CPR training becomes mandatory in schools, this strategy can significantly improve the rate of CPR in people present in the scene (21).

The results of the present study showed that 1 week and 2 months after the intervention, a statistically significant difference was observed in terms of the mean score of basic CPR self-efficacy in the face-to-face training group. This result indicated that face-to-face training was effective in increasing the level of self-efficacy of secondary school students, which was consistent with the findings of a study conducted by Heidarzadeh et al., entitled "Effect of computer and manikin simulation on nursing students' perception of self-efficacy in cardiopulmonary resuscitation" (16). Accordingly, the mean and standard deviation of students' perceptions of self-efficacy before and after the intervention were statistically significant in the manikin-based education group (Z=-5.23, P=0.0001) and computer-based education group (Z=-4.15, P≤0.0001). Regarding this, the mean score of students' perceptions of self-efficacy increased after the training in both groups. Nonetheless, no significant difference was observed between the two groups (P=0.41). Based on the findings of the mentioned study, both simulation methods increased the perception of self-efficacy in the field of CPR.

Rehberg et al. found in their study that the classroom environment played a role in the high quality of cardiovascular resuscitation skills (13). In another study, Nas et al. (22) examined CPR training on 381 individuals in two groups of face-to-face and virtual reality (VR). They concluded that individuals in the face-to-face CPR training were more successful in performing the chest compression technique than those in the virtual reality group. The mentioned study also confirmed the potential of short-term face-to-face training to achieve adequate CPR skills.

Based on the results of the present study, a statistically significant difference was observed in the mean score of basic CPR self-efficacy in the e-learning group 1 week after the intervention. This result showed that e-learning was effective in increasing collective self-efficacy among high school students, which was consistent with the findings of a study reported by Gonzi et al. (23) examining the relationship between the quality of CPR and self-efficacy in hospital simulation. The results of the mentioned study showed that the level of self-efficacy was below the mean score of 35.6%, while 26.8% and 38.5% of the participants self-assessed their self-efficacy at an average level of 5 and a range of 6-10, respectively. It was revealed that after the simulation, the sense of self-efficacy did not change in 38.3% of the participants; however, it increased in 30.5% of the participants and decreased in 31.2% of them.

In the current study, the mean score of basic CPR self-efficacy was increased in the e-learning group immediately after the intervention (4.498) and 2 months after the training (3.905). The results of the study performed by Nas et al. (22) showed that further development of education should be provided in the form of virtual reality. Additionally, they acknowledged that although VR might lead to broader CPR training, it was necessary to develop further face-to-face training courses to achieve more comparable CPR skills, especially in terms of chest compression.

The results of a study carried out by Fabius et al., which examined CPR by comparing two teaching methods, showed that there was no significant difference between the scores of knowledge and performance between the groups. However, significant differences were observed regarding the spent time, overall satisfaction, and success and failure rates in the traditional teaching method.

It should be noted that the results of CPR training vary depending on the demographic characteristics of the samples. According to the findings of some previous studies, demographic differences played a role in education. It was also found that the amount of exercise affected the self-efficacy in CPR performance. This indicated that controlling the difference in the quality of education according to the demographic group was necessary not only to increase the amount of exercise but also to improve self-efficacy (15).

The results of this study can help develop CPR education in Iranian schools. There has been school support and enthusiasm for this project, and based on our research, education can be created with minimal effort. Although the preparation of the AED device and its installment and usage training



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have increased in Iran after the announcement of the Presidential Circular (19 December 2018) on obliging all ministries and governmental and public institutions, it has not yet become a national approach. The reason for this issue is attributed to the fact that according to Presidential Circular, this task has been assigned to the relevant ministries. This shortcoming also exists in the Ministry of Education, and currently, public first aid training is provided by the Red Crescent Society without AED training in some schools and for part of the students if there they are volunteers.

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## Conflict of Interests

Authors declared no conflict of interests regarding the publication of the present study.

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