Evaluate the Effectiveness of Clinical Simulation and Instructional Video Training on the Nursing Students' Knowledge about Cardio-Pulmonary Resuscitation: Comparative Study

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Abstract **Aims:** To evaluate the effectiveness of instructional video training method of teaching about CPR in comparison with conventional format. **Methods:** A quasi-experimental design was conducted with 210 students. Students were randomly assigned to receive instructional video training (n = 111) or conventional format of teaching (n = 90). The primary outcome measure was the baseline to endpoint change in knowledge level. **Results:** A significantly higher overall post-test score was observed for instructional video training group as compared to lecture. **Conclusions:** instructional video training is as effective as conventional format of teaching in teaching and learning basic emergency skills.

Keywords: *simulation teaching, CPR instructions, clinical teaching*

1. Introduction

Several people encounter life threatening medical emergencies around the globe and it is a striking situation regardless of age, sex, race or cultural background. Furthermore, sudden cardiac arrest is a fatal emergency condition [1]. However, survival rate of cardiac emergency case accounted for rescues who trained equipped to provide emergency medical care either in the scene of attacks or in emergency care settings skills [2].

Cardiopulmonary resuscitation (CPR) is a lifesaving technique aims to restore spontaneous cardiac function in emergency situations, including heart attack or near drowning, in which someone's breathing or heartbeat has stopped. American Heart Association defined CPR as a combination of a chest compression and artificial ventilation to maintain circulation and oxygenation [1]. Indeed, patient had low chances of survival when the first responders (nurse) are not competent in performing the life-saving procedure of CPR [2]. Moreover, it has been demonstrated that rapid and competent response to such patients can increase survival rate. Consistently, a study by Ackermann [3] revealed that nurses can reduce mortality rate associated with when identified and managed promptly. Therefore, nurses must be prepared to provide an effective CPR in the event of cardiopulmonary arrest.

CPR is a psychomotor skills are taught to nurses throughout their medication education to be performed successfully in the event of a cardiac arrest. Broadly speaking, the nurses are the first responders to cardiac arrest cases in the hospital the undergraduate medical curriculum is mandatory to prepare and train nurses to work with critical ill cases [4]. Nurses and health care providers are responsible for the safety and rapid response to life threatening emergencies within or outside the hospital environment [5]. Nurses need to have basic knowledge and skills beside to emotional and psychological readiness to handle emergency cases properly as they may potentially involve in managing cardiac arrest in different settings (i.e. (hospitals, clinics, or home). Additionally, it is very important that nurses to have confident in their abilities to provide CPR for patients who need it [5]. These preparations require well education, and training for those nurses started at college, and continue with the rest of their career life.

Nursing education approach is crucial in providing society with knowledgeable, competent, and skillful nurses. Madden [2] defined CPR competency as encompassing acquisition and retention of CPR cognitive knowledge and psychomotor skills. Indeed, CPR competency is considered an essential skill for nursing students because nurses are the first responders to cardiac and respiratory arrest in hospital [6]. However, CPR abilities amongst nursing students' may enhance by

utilizing blended learning approaches of training as interactive online course, simulations, classroom-based course, handbook and self learning, computer-based lessons, and videos [7].

Basic Life Support (BLS) is a standardized life saving procedure which intends to ensure high quality of care in life threatening situation [8]. Chamberlain, Smith [8] indicated that university students education on CPR is fundamental topic for the society, since there is an urgent need to have qualified trained people. Nursing students training should them for postgraduate work to handle cardiac arrest situation as they will be staff nurse in different health care setting, it is essential to equip them with knowledge and skills to manage critical situations confidently. BLS training program is basic tool should be integrated in undergraduate nursing curriculum. As a result, CPR training programs should be tailored in the way to improve their performance [3].

Educational psychology recognizes that individuals may prefer various learning method [9]. Educators also need to distinguish that no single educational method satisfies all learning needs [10]. Interestingly, innovative approaches in CPR training. For instance, self-training kits make CPR training more accessible [11]. In this sense, Grześkowiak [12] and Braslow, Brennan [13] mentioned there is a need to develop more realistic approaches than conventional lectures in medical education. A similar idea was published by Lynch and Einspruch [11] and Todd, Heron [14] who found method of education (conventional vs online) did not influence outcome of learning process.

Importantly, Price, Bell [15] noted that the level of knowledge and skills related to CPR acquired after didactic education method was poor. In addition, it has been asserted that preserve information following this format of teaching is limited [15]. Curran, Aziz [16] used an innovative online delivery format for a CPR targeted at undergraduate nursing students. The results demonstrated that study participants had an increased knowledge level and skills of CPR and this improvement was retained for up to nine months after intervention in comparison with conventional method of teaching.

Similarly, it has been stated that conventional method of teaching is passive and less likely obtained knowledge of this format to maintain longer compared with active learning methods such as simulations, computer-based lessons, and interactive videos [17,18]. In the context of negative findings associated with conventional teaching format, the current trend in delivering effective CPR training for nursing students is instructor-based courses. Although it is a recent trends in nursing education, it has several drawbacks; this is demanding format of teaching, cost-effectiveness, lake of team training aspect, and low confidence among trainees after complete training [19]. In the same vein, paucity of the non-technical skills in education process (attitudes, behaviors, situation awareness and decision making) which are not systematically addressed in current training programs [8].

Knowledge level improvement after a CPR by utilizing active teaching format was further explored by Mäkinen, Castren [20], who compared distance learning format and conventional teaching strategy, authors concluded that overall performance of traditional group was significantly better compared with other group. The major drawback of this study that sample size is small and attrition rate was high in distance learning group (44.5%), which might limit generalizability of the study findings. However, Todd, Heron [14] indicated that conventional teaching of CPR courses convey bulk of information, including facts that are not essential to the performance of CPR. Moreover, Churkovich and Oughtred [21] reported that students who attended class sessions about CPR achieved higher post-test scores than students completed CPR through online library instruction.

Video approach is a viable modality of teaching to support and supplement of the CPR courses conducted to health care professions in remote areas [22]. Todd, Heron [14] highlighted video instruction provides a simple, precise instruction than Conventional style of teaching CPR. Another advantage has been discussed in the literature that video format of teaching requires shorter time for training than Conventional approach. In addition, video approach of teaching might relieve some of the trainee anxiety about being in a classroom with several strangers and might lead to more effective learning [23]. Notably, an instructional video approach could provide learners with a different representation to facilitate multiple exposures to the same material and thus promote better learning for some students [24]. While Schimming [7] investigated student preference of teaching format and reported that video format is highly preferred compared with lecture style learning. Similar findings were reported in the United Kingdom by Spence, Derbyshire [25], who evaluated the impact of video compared to verbal feedback in assessment of student CPR performance. The findings showed that students were received video feedback exhibited significant improvement in overall performance scores compared to those received verbal feedback.

In other context, a recent study supported positive effect of blended format of delivering statistics course. The first group "on site group" received statistical session and second group received session by utilizing blended education method. Milic, Trajkovic [26] found that mean final exam score, knowledge test score and grade point average (GPA) was higher in blended education group. This interpretation is inconsistent with that of Saiboon, Jaafar [27], who argued that format of teaching about CPR (self-instructed video versus face to face) did not influence outcome skills (basic airway management (BAM), cervical collar application (CCA), manual cardiac defibrillation (MCD), and emergency extremity splinting (EES) skills). This might be attributed to sample characteristics as the students were chosen in the first year level and they were not yet learned much about 'basic emergency skills. Additionally, poor reporting of study methodology and small sample size renders the study results non-generalizable outside study context.

Conventional CPR classes frequently include wide range of content, including topics on the prevention of heart disease and on early recognition of a heart attack with less emphasis on technique of CPR. This, in turn, increases class duration and provokes additional anxiety that might interfere with learning [28]. Furthermore, delivering CPR with a conventional format of teaching affords learners with the opportunity to practice their skills on a CPR manikin. However, video self-instruction does

not incorporate the use of actual CPR manikin during training [29]. In a study conducted by Smith, Colquhoun [30] pointed out that combination of teaching strategies such as video or voice feedback manikins with traditional class room improved CPR learning. The present study fills a gap in the literature by comparing two formats of teaching (clinical simulation CPR training and instructional video training) with large sample size.

This study aimed to assess nursing students' acquisition of CPR knowledge using two different instructional methods (clinical simulation CPR training and instructional video training). This investigation attempts to answer the following research questions:

1. Are there any differences in nursing students' CPR knowledge after receiving CPR instruction using two different teaching methods (clinical simulation CPR training and instructional video training)?
2. Are there any relationship between nursing students' CPR knowledge and their demographic variables?

2. Methodology

2.1. Design

This study was utilized two-group pretest, posttest quasi-experimental design. Students participated in this study were randomly assigned to receive CPR training instructions in the form of clinical simulation training (n = 90) or instructional video training (n = 111). This study was compared the pre and post test scores between and within group for each teaching strategy.

In terms of clinical simulation training, lecture consisted of one lecture with demonstration lasted 120 minutes. An experienced registered critical care nursing (One PhD nurse and two master holders) who worked in the acute care setting was responsible for conducting the session to maintain consistency. Video lecture remained for 30 minutes with demonstration. The study was conducted in the period between September 2010 and January 2011 (three consecutives academic semesters). Participants were received a written pre-test prior to both instructional approaches. They then received CPR instruction either by clinical CPR lecture, or by video. Following instruction, trainees were given written post-tests. There were no exclusion criteria.

2.2. Sample

Study sample was recruited from nursing students registered in clinical critical care course. The recruitment extended for three consecutive semesters, starting in fall 2010 and end in fall 2011. Students were recruited at the beginning of orientation session of the course. Study protocol was approved by IRB committee at Al-bayt university. The final sample consisted of 201 students. 90 students were allocated in the clinical group and 111 students were assigned to video group.

All of them signed the written consent after a full explanation of the study and their rights. Demographic data of the participants were obtained. A research nurse conducted pre-assessment for both groups before the

implementation of CPR training instructions; it was implemented as a part of critical nurse clinical course were commenced. To facilitate the attendance, two repeated sessions were conducted per week (one on Sunday and one on Monday). Students had the freedom to choose which session they would like to attend. Post-assessment was conducted immediately after the lecture or video by the research team. One outcome measure was used: CPR cognitive knowledge.

This outcome was chosen based on the assumption that lecture or video would increase students' knowledge about CPR steps that they would feel more confident and more supported, thus improving their CPR performance. All data collection sheets were coded with an index number and at the end of the study all raw data were saved with principle researcher. All subjects were assured that they could withdraw from the study at any time without penalties. Moreover, scores of tests were used only for purposes of the study and were not part of the course grade.

2.3. Instrument and Data Collection Procedure

Students' CPR cognitive knowledge was assessed by a 24 items, the instrument was adopted from AHA. Some modification was performed by instructors to be comparable with the course requisite. Cronbach's Alpha of the modified scale was (0.779) [3]. Demographic data such as age, gender, tawjihi grade and branch, and students' university average was also obtained, in addition to information about previous experiences in CPR. Equality of the video presentation and the traditional lecture content was confirmed by experienced critical-care nurse educators who are involved in teaching the baccalaureate critical-care course. Before providing training CPR courses, students were asked to completed the knowledge MCQ pre-test and post-test immediately after lecture or video. Content validity of the modified scale was assessed and approval by an experts panel from Jordan and the United State. These experts were certified as trainer from the AHA.

2.4. Data Analysis

Statistical analysis was carried out using the statistical software package SPSS version 16 (SPSS Inc., Chicago, IL). Descriptive analysis was used to describe the sample. Paired *t* test was used to examine the overall changes of the pre-test and post-test scores within group. Independent t test was also employed to compare the post-test score between groups. Statistical significance was set at $p < 0.05$.

3. Results

3.1. Sample Description

Two hundred and one students attended critical care nursing course provided consented and were randomly allocated to CPR training instructions in the form of clinical simulation training (n = 90) or instructional video training (n = 111) as shown in Figure 1. Baseline characteristics of

participants are shown in Table 1. There was no statistically significant difference between the groups on baseline characteristics at the 5% level of significance. The mean age for students was 21.8 years ($SD = 2.0$). Majority of participating students were females (77%), never attending real CPR (73.1%), and their high school tract was health tract (78.2%). Of the total participating students, 8% of students have an accumulative average ranged between 81-90% (Table 1). Preliminary test was carried out and assumptions of t test were assumed.
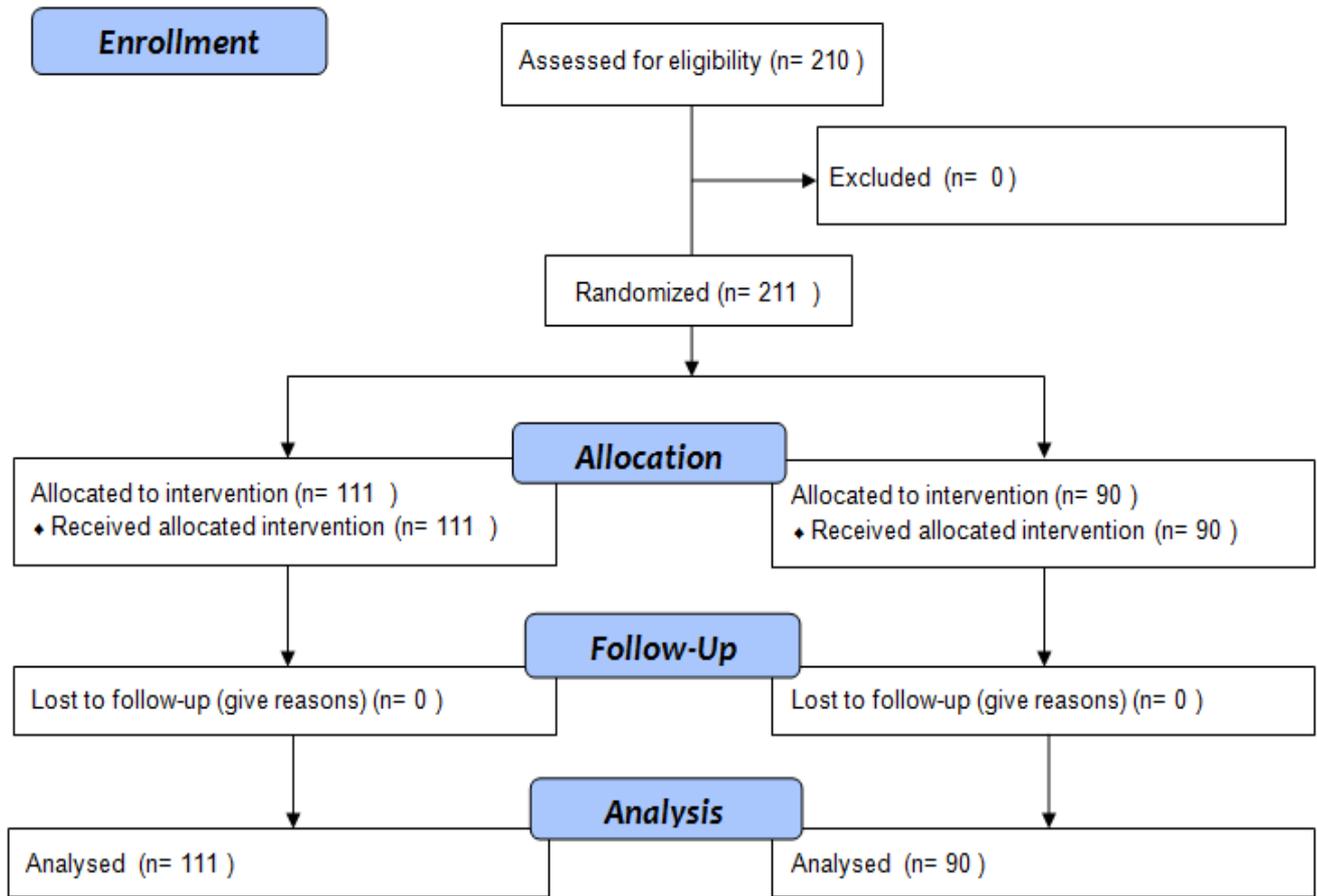

Figure 1. Participants progression in the study

Table 1. Sample Characteristics

Categories	Clinical Simulation Group, n (%)	Video Group n (%)	Total
Sex			
Male	35 (38.9)	21 (18.9)	56 (27.9)
Female	55 (61.1)	90 (81.1)	145 (77.1)
Age			
18-20	20 (22.2)	20 (18.0)	40 (19.9)
21-23	63 (70)	78 (70.3)	141 (70.1)
> 24	7 (7.8)	13 (11.7)	20 (10.0)
High School Track			
Health Track	67 (74.4)	90 (81.1)	157 (78.2)
Non Health Track	23 (25.6)	21 (18.9)	44 (21.9)
University Cumulative Average (GPA)[a]			
60-70	42 (46.7)	47 (42.3)	89 (44.3)
71-80	39 (43.3)	56 (50.5)	95 (47.3)
81-90	9 (10)	7 (6.3)	16 (8.0)
Attending Real CPR			
Yes	28 (31.1)	26 (23.4)	54 (26.9)
No	62 (68.9)	85 (76.6)	147 (73.1)

[a] One case missing value on video group.

Table 2. Student's scores of both clinical group and video group in pre-test and post-test

Test/ Group	Video (n = 111)	Simulation (n = 90)		Total (N = 201)
	M (*SD*)	M (*SD*)	*t*	M (*SD*)
Pre test	8.9 (2.8)	9.1 (3.0)	0.32	9.0 (2.9)
Post test	13.4 (2.9)	14.6 (2.9)	2.8*	13.9 (3.0)
t	14.9*	13.0*		19.5*

* Significant at *p* value > .05.

Before starting the CPR training there was no significant difference in the pretest scores among the students in the both groups, *t* (99) = 0.32, *p* = 0.70. However, the overall students in both groups demonstrated significant improvement in the posttest scores regardless which type of teaching methods were received *t* (200) = 19.5, p < 0.001. Expectedly, students in the video group exhibited a higher post-test mean score than students in the clinical simulation group, *t* (199) = 2.8, *p* = 0.006, as illustrated in the Table 2. Interestingly, this current study findings showed that there was no significant difference in the mean posttest scores for students entering undergraduate nursing program from high school health track or none-health track, *t* (200) = 1.1, *p* = 0.25. Also, there were no significant difference in the mean post-test scores for students whether attended a real CPR or never attended real CPR, *t* (199) = 0.17, *p* = 0.86.

4. Discussion

The findings of this study indicate that students lacked CPR cognitive domain of knowledge at pre-test. This result is consistent with Madden [2], who found that students lacked CPR cognitive aspect of knowledge at baseline test. This might be explained potentially by the fact that regular resuscitation training as recommend by AHA should be initiated and implemented for all hospital staffs who are in direct contact with patients [1]. At international level, there is no implicit rule or policy obliged undergraduate nursing student to receive CPR training during the early stages of an educational program [31]. Whereas, Paul [32] reported that there is an education institution, particularly in Western-American countries emphasized nursing students have to pass the CPR objective structured clinical examination before progressing to the second year. Learning CPR is an essential priority for nursing students [33]. Moreover, this author also concluded that nursing students did not obtain satisfactory level of CPR knowledge and performance skills during their study in the university. In the context of the current study, in Al-Bayt University where the study conducted, CPR training only offered to students at the beginning of critical care course.

In light of this important information, the current study's findings appear to be consistent with those of a previous study [34,35], in which the students showed an improvement in their scores in both groups which highlighted the need of CPR sessions for students. These results are in accord with recent studies indicating that an improvement in participants' knowledge among experiment and control groups after being exposed for online or didactic lecture style in the university [36,37].

Surprisingly, one striking finding of the current study was that the weight mean difference in the knowledge scores were significantly detected at post-test among students attended video CPR clinical training compared to lecture style. There is not a theoretical or clinical basis that would suggest that the same usage by different individual should produce the same effects, or that usage should be directly comparable between individuals in terms of its effects. This confirms the benefits of what was previously known; people retain 10% of what they see, 20% of what they hear, half of what they see and hear, and 80% of what they see, hear and do [38]. Improvement in video group of this study might be attributed to the fact that video based education is flexible approach, allowed students to access content at their peace and time convenient. In other context, author noticed a significant improvement in the post-test knowledge statistics score following online education compared with those received didactic format of teaching [26].

These results indicate significant effect of both training program that adapted in this study. Kardong-Edgren and Adamson [33] indicated that, most of current CPR teaching approaches (including classical lecture and video) provide training to meet course requirements but not enough perform CPR. In contrary, Price, Bell [15] found that despite the instruction strategy used in training CPR related knowledge and skill acquisition as well as retention was still poor.

The results of this study indicated no significant differences of students' knowledge in term of gender, age, average GPA, and Tawjihi tracks. These results may be related to the fact that all students expose to the same materials regardless their demographic characteristics. There is not published study performed subgroup analysis to compare knowledge score based on demographic factors apart from Toner, Connolly [39], who reported that male students had relatively higher differences in knowledge post-test scores following training as compared to female students.

The result of this study showed that students in clinical CPR lecture group demonstrated significant improvement of knowledge post-test immediately. This might be explained by the presence of instructors who provide answers to students questions and feedback to satisfy their needs. This result is further supported in previous studies (Chamberlain [8,20,21,40,41]. Likewise, Spooner, Fallaha [42] showed that feedback has positive effects as guiding the learner to the correct response. This study results largely support those of previous medical education studies, showing that traditional classroom of CPR courses may afford learners with the opportunity to practice their skills on a CPR manikin.

Conversely, other studies appeared to illustrate the superiority of the traditional CPR group than didactic group. This inconsistency might be due to exclude demonstration part from the video, unequal sample size and high attrition rate which rendered this finding non generalizable outside study contexts [3,13,14,23,29]. Whilst, Lynch and Einspruch [11] concluded that there is no significant differences between online or didactic style of learning between groups. It is difficult to explain this result, but it might be related to small sample size and poor reporting methodology.

The most interesting finding that can be drawn from all of the studies reviewed in this section is that students who read article related to CPR or taking CPR courses had no apparent differences than student who did not, however, students who see actual CPR got higher score. These results supported by Ackermann [3] indicated that being exposed to CPR situation on real person was associated with achieving higher score in pre-test compared with students who had not performed CPR or had experience in doing CPR on a real person, as evident by scoring lower score on the pre-test.

It is not surprising to note pre-test score was poor among students allocated in both groups. This is partially explained by the fact that this was the first time for those students to experience CPR related training. As stated above the majority of students did not take previous CPR courses or training, or see actual CPR or even read materials regarding CPR. This is in line with previous report who reported a low pre-test knowledge score about CPR among nursing or medical students.

4.1. Strengths and Limitations

The strength of this study includes using quasi-experimental design and random allocation of the two groups. In addition, another study strength is that data collected underwent simultaneously in both groups. This might minimize the effect of extraneous variables. Moreover, it is the first study carried out in Jordan and investigated students' knowledge of CPR and compared two teaching approaches. This is the first study in this field of research had a adequate power to detect difference between groups. Although this study has strengths, it has some limitations. The limitations of this study were the knowledge test was measured immediately after training which minimized to evaluate long term effect such approach of teaching. Further study is needed to have longer follow-up. Another limitation was the study conducted in one group of students who enrolled in critical care course, therefore, this result cannot be generalized to all nursing students. It will be better if the study conducted on other group of students.

5. Conclusion and Recommendation

A variety of training methods for CPR knowledge and skills can be evaluated for improved learning outcomes. Expanding sample and involving multiple nursing education sites can provide insight into training outcomes and promote generalization. It will be better if we conducted the study in other nursing colleges in Jordan or in next year students in the same course and compare the results. More research is needed to explore alternative methods which improve the survival rates for those in our care.

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