



Original research

Comparing two teaching methods based on concept map and lecture on the level of learning in basic life support

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ABSTRACT

Education and training about Basic Life Support is necessary for different medical groups such as nurses. Different teaching methods have been developed to preserve essential medical information, knowledge and skills. The purpose of the study was to determine the effect of concept map-based and lecture-based teaching methods on the level of nursing students' learning in Basic Life Support.

This quasi-experimental study was conducted in 2015 on 57 nursing students from a nursing school in Tehran. Students were selected by census and then divided into lecture (n = 29) and concept map groups (n = 28) by random allocation. The effect of education on knowledge (before, immediately after, one week after and one month after session) and practice (before and immediately after session) was studied.

No significant differences were found between the mean scores of knowledge and practice before intervention ($P > 0.05$). After intervention the mean scores of knowledge were not statistically significant between the two groups ($P > 0.05$) but mean scores of practice were significantly higher in the concept map group ($P = 0.03$).

In achieving skill and practice goals, it seems that the concept map-based teaching method was more effective than the lecture method.

1. Introduction

Cardiac arrest is one of the most important causes of the mortality and morbidity throughout the world. Studies have indicated that in the recent decades (1996–2019) the growth of this problem has generally increased (Zhang et al., 2014). Approximately 360,000 and 60,000 people die each year in the United States and England respectively as a result of sudden cardiac arrest (Gaieski et al., 2017; Hawkes et al., 2017). In a study conducted in Iran, the rate of successful CPR (cardiopulmonary resuscitation) was 59.5%. The result show that 93.3% of these patients died and 6.7% of patients were discharged from hospital (Dolatabadi et al., 2005). On the other hand, a rapid and effective initiation by a skilled resuscitation team could obviously decrease mortality rate and improve the resuscitation outcomes (Javadpour et al., 2016). Therefore, prompt and effectual commencement of CPR could play an important role in the final consequences of resuscitation (Mardegan et al., 2015).

Nurses are frequently the first ones who deal with the patient (Roh and Issenberg, 2014). They have to start to give BLS until the all of advanced resuscitation team arrives. Thus, it is expected that they should have sufficient knowledge and skills (Hernández-Padilla et al., 2016). According to Roh and Issenberg (2014) most nursing students had inadequate skills in resuscitation on a mannequin. Also, Mäkinen et al. (2010) study on the basic CPR skills and the use of defibrillator indicated that the nursing students in Finnish and Swedish hospitals had inadequacy of the CPR skills in both hospitals.

In addition, other studies reported that sometimes nurses, nursing students and other medical team personnel had poor, inadequate or forgotten skills of resuscitation (Anderson et al., 2012; Mokhtari Nori, Saghafinia, Kalantar Motamedi and Khademol Hosseini, 2012; Saramma et al., 2016; Sutton et al., 2011). In fact, inadequate skill of BLS teams is one of the principle problems in CPR. Anderson et al. study about CPR Skill Retention illustrated that, CPR skills could decrease

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with the length of time and lack of practice. The results suggested using methods of refreshing and repetition/practice of skills may be useful within teaching (Anderson et al., 2012). Since, skill is deeply related to the theoretical knowledge of the individual, researchers seek effective teaching methods in order to empower students and clinical personnel to acquire knowledge, retain information and carry out medical emergency procedures correctly.

The lecture-based teaching method is one of the most commonly used methods in the medical science curriculum. It is a teacher-centered method and has some other features such as simplicity, suitability for crowded classrooms, the huge size of educational materials and time limit. Therefore, lecture-based teaching is appropriate method in educational programs (Lucieer et al., 2016). Because of students are passive in this method, it may not be proper for the teaching of practical skills and reinforcement of mental skills at higher levels of learning (Kumar et al., 2015; McGarr, 2009).

Educational theorists have recently concluded that modern teaching methods such as concept mapping significantly promote learning and could provide better and deeper learning in learners instead of superficial learning (Huang et al., 2017; Wilgis and McConnell, 2008). The necessity of modern and active learning methods in educational systems is obviously clear (Horvath et al., 2013). The concept map-based teaching method is one of the modern educational methods that promotes significant learning and deeper perception of medical science (Cutrer et al., 2011; Kinchin, 2014). A research conducted on the effect of concept map in the medical education process considered concept maps as a suitable strategy and potential method for such education (Daley and Torre, 2010; Daley et al., 2016).

Opposite to lecture based teaching method, the concept map is a student-centered method which helps to improve students' critical thinking and decision making skills in both classroom and clinical setting (Gerdeman et al., 2013). Some previous studies represented that the concept mapping method could be more effective for improving cognitive learning, clinical observation skills, critical thinking skills, meaningful learning levels and creativity than lecturing method (Chan, 2017; Gerdeman et al., 2013; Moattari et al., 2014).

The idea of concept map was first developed by Novak and Gowin in 1984 based on Azubel's significant learning theory and has been applied in education system for more than 30 years (Kinchin, 2014). Concept map is a graphical representation which expresses the relationship between two concepts and also their relationship with other concepts related to a specific subject. In this model, concepts are arranged in pyramids and their relationship is determined in up-down and side-by-side forms (Daley and Torre, 2010; Kinchin, 2014; Torre et al., 2013).

Several studies have been conducted on the effect of the concept map-based teaching method in nursing such as studies investigating the application of concept map in knowledge domain, including creating and strengthening learning and cognitive skills in a certain course (Bramwell-Lalor and Rainford, 2014; Chan, 2017; Cutrer et al., 2011; Dong et al., 2015; Hagell et al., 2016; Liu and Lee, 2013) or its effect on cognitive skills such as creating and strengthening critical thinking and improving clinical decision-making skill (Gerdeman et al., 2013; Huang et al., 2012; Lee et al., 2013; Pudelko et al., 2012).

There is no agreement on the best teaching method in previous studies. However, no study has been conducted yet regarding examining the effects of concept map on cognitive learning and practice. For this reason and due to inadequate resuscitation skill in nurses and nursing students and also the necessity of resuscitation re-education, the present study has determined the effects of two teaching methods based on concept map and lecture on the level of knowledge and BLS skill among nursing students.

2. Purpose

The purpose of the study was comparing of two different variables, lecture and practical teaching methods versus concept map and

practical teaching on knowledge retention amongst nursing students at one week and one-month post exposure.

3. Research methods

3.1. Research design

This quasi-experimental study has been conducted in the Military nursing school of Tehran, Iran in 2015. In total, 57 first term nursing students participated in the study.

3.2. Sample

Based on Kaddoura et al. (2016) study, sample size was calculated with G*Power version 3.0.1.10. The probability of Type I error (α -level) was 0.05 or 5%, the probability of Type II error (β -level) was 0.2 or 20% and the effect size was 0.82. With regard to 10% probability of sample loss, the sample size was calculated about 28 students in each groups.

Finally, 57 students were eligible to participate. Students were selected by census from first year nursing students. The purpose of the study was explained for them and informed consent was obtained. Participation in the study was voluntary and had no effect on learning. The selected students were divided into lecture ($n = 29$) and concept map groups ($n = 28$) by random allocation. The inclusion criteria were first year nursing students who didn't have any theoretical education and clinical experience about CPR. The participants should have scored less than 70% in their pre-test scores. The exclusion criterion was missing even one session during the educational period. No subjects were excluded during this study.

3.3. Data collection instruments

Two questionnaire and one checklist were used in this study. The first one was demographic data included age, gender and mean diploma. The second was a multiple choice questionnaire with 20 questions. The first seven questions measured the low levels of knowledge and the others were based on Bloom's taxonomy of cognitive goals and measured the level of perception and application in the form of scenario and introduction. The score 1 represented the correct answer and the score 0 the wrong answer. The total score of the test was calculated from the sum of the scores.

In order to measure the practice of students, a checklist of adult CPR practice created by the researcher (based on guideline of American Heart Association in 2015) was used as a standard instrument. This list included 31 items related to correct performance of basic resuscitation with answers in "Yes" (correct resuscitation) or "No" (incorrect resuscitation). If all students answered every item correctly, they would obtain the score of the item and correct option would be ticked; otherwise, incorrect option would be considered.

In order to confirm the face validity of the questionnaire and checklist, 15 newly graduated students who had experience of performing CPR and emergency situations were interviewed face-to-face. These people were not part of our study. In this step; difficulty, appropriateness, and ambiguity of items were studied. Their opinions about writing style and clarity were applied and unclear items were revised.

In order to determine the content validity of the knowledge questionnaire and practice checklist; the grammar, application of proper words, proper arrangement of items and proper scoring were verified by 13 experts among Faculty Members of Aja University of Medical Sciences. Then the essential changes were applied in the questionnaire and checklist based on their comments.

In order to determine the reliability, *Test-Retest* was done by 15 students who were not part of the samples. The time interval between the test and the retest was two weeks. Correlation between two test times was investigated with *Spearman–Brown* formula (Ali et al., 2016).

An acceptable reliability score was the correlation coefficient 0.5 and higher (Heale and Twycross, 2015). According to $r = 0.86$ and $p = 0.02$, results showed a significant correlation between the scores of test and retest. Cronbach's alpha test, used for internal correlation ($\alpha = 0.8$).

The reliability of the practice checklist was performed by two examiners who separately and simultaneously observed and scored 25 students. These students were not part of our study. According to Kappa statistics, the interrater agreement was 93%.

3.4. Procedure

The research was approved by the Ethics Committee of the Aja University of Medical Sciences (ethics ID: IR. AJAUMS.REC.1395.03). In this study, ethical points of declaration of Helsinki have been considered, such as explaining goals to subjects, taking written consent, ensuring the right to withdraw from the research at any time, being honest in choosing samples and in data collection and analysis, sharing results with the subjects and the authorities of the research setting and appreciating all subjects and authorities who helped us in this study.

First, textbooks and scientific papers pertaining to BLS were studied and the educational content was prepared with translation of basic resuscitation from the CPR guideline of the American Heart Association in 2015 (Kleinman et al., 2015). The validity of the educational content was verified by nursing educators at the Aja University of Medical Science who were specialized in critical care nursing and CPR. The valid content was prepared in the power point slides in order to teach both groups. The pre-test of knowledge and practice was given before intervention in concept map and lecture groups. In both groups, BLS was taught in two 120-min sessions and then practical training was given at a 180-min session. Practical education was administered separately but similar in both groups. All pre-tests, post-tests, practical and theoretical training were held on different days.

For teaching theoretical sessions in the concept map group 34 slides were prepared based on a concept map method. C-map Tools were used to plot the concept maps. These PowerPoint slides included maps for every stage of the resuscitation. In addition, an overall concept map was prepared based on the educational algorithm of BLS and Guideline 2015. After each theoretical session the students were asked to plot a concept map about what they had been taught. At the beginning of the next session the instructor was given proper feedback about the concept map which was prepared by the students. In addition, some scenarios were presented about different types of relief and aid to patients. At the same time, students were asked to illustrate their concept map.

The theoretical education of the control group (lecture) was presented in a similar time in two 120-min sessions based on the lesson plan. It was planned in the form of a lecture using 54 PowerPoint slides. Finally, doubts and confusions were settled by asking and answering questions in the classroom. Practical education was performed through medical manikin in a 180-min session same as concept map group.

At the end of the theoretical and practical sessions the first post-test of knowledge and practice was given. The post-test included knowledge evaluation by questionnaire and practice evaluation by the checklist. Also, two post-tests of knowledge retention were given -one week and one month later- but the students were not informed about the time of tests. These two post-tests only included the knowledge test. It should be noted that the practice checklist was completed by the researcher assistant who was not aware of the groups (single blind).

Data were analyzed using SPSS version 22, Smirnov–Kolmogorov statistical tests, Fisher exact test, independent T, repeated measures ANOVA (RM ANOVA).

4. Results

The personal features of participants such as gender, marital status, previous education, clinical work experience, age and diploma average

Table 1
Frequency distribution of personal features of subjects.

Variables		Concept map n (%)	Lecture n (%)	χ^2	p
Gender	Female	12 (42.9)	12 (41.4)	0.01	1
	Male	16 (57.1)	17 (57.6)		
Marital status	Married	1 (3.6)	0 (0)	1.05	0.49
	Single	27 (96.4)	29 (100)		
Age ^a		19.32 ± 2.19	19.34 ± 1.17	0.05	0.96
Mean diploma ^a		18.56 ± 0.63	18.52 ± 0.96	- 0.18	0.85

^a Age and mean diploma are presented as M (SD) and evaluated using a t-test rather than χ^2 .

Table 2
Comparing knowledge scores before and after intervention in each group.

Knowledge learning	Lecture	Concept map	t ^a	p
Pre-test	5.82 ± 2.91	6.6 ± 2.97	0.99	0.32
Post-test	17.24 ± 1.92	17.85 ± 1.58	- 1.31	0.19
Retention 1 (one week after education)	17.75 ± 1.8	18.35 ± 1.25	- 1.44	0.15
Retention 2 (one month after education)	16.89 ± 2.58	16.67 ± 3.47	0.26	0.78
F ^b	282.26	148.71		
p	< 0.001	< 0.001		

Note. Data presented as mean (standard deviation).

^a Independent t-test.

^b RM-ANOVA.

have been shown in Table 1. Results of the Smirnov–Kolmogorov test showed normal distribution data and no significant difference between the two groups regarding personal features ($P > 0.05$).

Mean scores of knowledge domain have been demonstrated in Table 2 for both groups before and after the sessions. Results indicated a significant difference in the two groups before and after the sessions ($P < 0.001$) and confirmed the sessions effectiveness on both groups. However, the comparison of mean scores of knowledge was not statistically significant in the two groups in the post-test ($P > 0.05$). Nevertheless, results (Table 3) indicated a significant difference between groups regarding total scores of practice after the session. Total scores of practice in the concept map group were higher than those in the lecture group ($P = 0.03$). In spite of that, there was no significant differences between groups regarding total scores of practice before the session ($P = 0.91$).

5. Discussion

Results show that, although the level of knowledge and practice of nursing students about BLS was low in both concept map and lecture groups before the intervention, it was increased in both groups after the intervention. No significant difference was found between the groups regarding knowledge. But students of the concept map group compared

Table 3
Comparing practice scores before and after intervention in each group.

Practice Learning	Lecture	Concept map	t ^a	p
Pre-test	2.2 ± 2.35	2.14 ± 2.3	- 0.1	0.91
Post-test	25.03 ± 3.04	26.64 ± 2.64	- 2.12	0.03
t ^b	- 40.17	- 45.73		
p	< 0.001	< 0.001		

Note. Data presented as mean (standard deviation).

^a Independent t-test.

^b Paired t-test.

to the lecture group had a better performance in the practice domain. This difference between teaching methods was significant ($P = 0.03$).

The findings of this study indicated that there was no difference between knowledge scores in the two groups at any time. These results are different from the results of some other studies. As an example, [Dong et al. \(2015\)](#) studied the application of concept maps on the promotion of learning and interpretation of electrocardiogram between the medical sciences students in China. In this study 126 medical students were divided into two groups—63 students in Group A, who learned electrocardiogram interpretation via concept map and 63 students in Group B, who were taught traditionally. Reporting results of the statistical test show a significant difference in using concept map in the promotion of learning and interpretation of electrocardiogram. Of course no significant difference was found between Groups A and B regarding features completion index. [Cutrer et al. \(2011\)](#) also studied the patients' diagnostic rates of pulmonary problems by residents and compared the effect of concept map method with the lecture method on learners. Results indicated that the concept map method enhances knowledge and deep understanding in medical students. The different results between our study and the study conducted by Dong and Cutrer can be caused from the following reasons: 1. Our participating students in this study were not familiar with the concept map teaching method. 2. The duration of our study was 4 h whereas in the study conducted by Dong Group A was taught about the interpretation of electrocardiogram via concept method for 10 h 3. Our data collection instrument was different from the data collection instrument used by Cutrer. Whilst, we used a researcher made questionnaire with 20 multiple choice questions to measure the knowledge in Cutrer's study the assessment of the knowledge was conducted by plotting 3 concept maps by participants. It seems that the use of concept map method requires more time to change the knowledge score.

Unlike the knowledge, the results of the present study suggested that the concept map method was more effective on the practice of students in CPR was more effective than the lecture method. No study has been found, which measures the effect of the concept map teaching method on clinical skill or psychomotor skill. Therefore, the present study is innovative in this regard. The effect of the concept map teaching method on critical thinking and problem-solving skill had been investigated in different studies ([Adams, 2015](#); [Huang et al., 2012](#); [Lee et al., 2013](#); [Öztürk et al., 2015](#)). The independent variable in our study was also different from those studies. Although, we assessed the BLS skills, those studies had considered the cognitive skills (critical thinking and problem solving) as the independent variable. In this study, the performance of students with regard to the BLS skills assessed by a checklist containing 31 items. In the other words, the students demonstrated BLS on the mannequin and the checklist was evaluated by a researcher assistant who was not aware of the groups (lecture or concept map).

The aim of the present study was the examination of the impact of the concept map teaching method on both knowledge and student's practice. At this study, the knowledge of the concept map group did not differ from the lecture group but their practice regarding the demonstration of BLS was better than the lecture group. The possible reason for this result may be this fact that in the process of the concept map plotting the learner personally with help of his own concepts adds the information to the cognitive structure and so potentially has the ability to develop the meaningful learning. This fact led to the better practice of the concept map group students.

6. Conclusion

According to above, we can conclude that the effect of the concept map teaching method -a modern educational method to promote knowledge in a short period (three sessions)- is not different from the traditional one (lecture) and both of them can be effective in theoretical education, according to educational time, number of participants and

their scientific knowledge. Since, the goal of learning in nursing is to acquire complex knowledge and to apply it in practice and since the scores obtained from psychomotor in the concept map group were higher than those in the lecture group, it seems that, the use of active teaching methods such as concept maps could be useful. Whilst the result of this study suggests that may well be value in using concept map as a teaching method in practical courses can be valuable and useful, further and more expansive researches are required in order to substantiate this claim.

7. Limitations

A limitation of this study was the lack of longitudinal study looking at how the use of concept map aids clinical reasoning, problem solving and transfer within BLS. One week and 4-week post teaching was a limited time frame for assessment.

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Authors' contributions

Conceived and designed the experiments: Shahla Aliyari, Amir Hosein Pishgooie, Marjan Seyed Mazhari. Performed the experiments: Azadeh Abdi, Mohammad Reza Nazaei. Analyzed and interpreted the data: Amir Hosein Pishgooie. Contributed reagents, materials, analysis tools or data: Shahla Aliyari, Amir Hosein Pishgooie. Wrote the paper: Shahla Aliyari, Amir Hosein Pishgooie, Azadeh Abdi.

Conflicts of interest

There are no conflicts of interest.

Ethical issues

This study was approved by the Ethics Committee of AJA University of Medical Sciences (ID: IR. AJAUMS.REC.1395.03).

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.nepr.2019.05.008>.

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