

Conference Paper

The effectiveness of blended learning in basic life support training among nursing students: A systematic review

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Abstract

Coronavirus 2019 (COVID-19) is a global health problem and poses challenges in various fields, including education. Some training programs such as Basic Life Support (BLS) training need to adapt to new policies, which are physical and social distancing. Blended learning by combining face-to-face with online training, may help achieve BLS competencies for health care professionals, including nursing students. This systematic review was conducted to explore blended learning effectiveness in BLS training for nursing student populations. The electronic search strategy was conducted from PubMed, CINAHL, Embase, Web of Science, and Cochrane for the years 2010 to 2020 with full text in English. This review followed the PRISMA guidelines. The initial search yielded 240 studies, and six of those studies were eventually included. The results reported there were three blended learning models appeared, including face to face learning combined with e-learning website, combined with video-based, and combined with computer-based simulations. With an intervention duration of four hours to two weeks, there was an indication of several improving outcomes, including skills, knowledge, attitudes, self-efficacy, problem-solving abilities, and willingness to perform resuscitation. Furthermore, the skill outcome is significantly more effective in blended learning of face-to-face models combined with the e-learning website and combined with computer-based simulations. The knowledge outcome parameter likely is the most effective from all of three blended learning models. These findings imply that BLS training needs to use blended learning models by modifying the training modules, facilities, and infrastructure as consideration.

Keywords: Basic life support, blended learning, nursing students, systematic review

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1. Introduction

Cardiovascular disease (CVD), specifically out-of-hospital cardiac arrest (OHCA), leads to death with varying survival rates. One of the efforts to improve OHCA survival is giving

adequate Cardiopulmonary resuscitation (CPR). Relatedly, it is essential to intensify the proportion and quality of trained people, including nursing students.

Coronavirus 2019 (COVID-19) is a global health problem and poses challenges in health, economy, and education [1]. Several regulations have been made to break the COVID 19 distribution chain, including physical and social distancing. This policy will have implications for implementing health training, one of which is Basic Life Support (BLS) training.

Several training programs have been carried out with a model that continues to grow. Starting from the traditional face-to-face model, using video aids, and online-based training. As a result of this pandemic situation, blended learning between traditional and online models can be developed. Therefore, this review will identify and synthesize blended learning on BLS and its impact on nursing students. This review's results are expected to provide information that will be useful in the implementation and development of blended learning, especially in the current pandemic situation.

1.1. Background

CVD is a leading cause of death worldwide and has received significant attention in recent years. OHCA incidence and survival rates vary considerably [2]. CPR is a vital technique used in cases of cardiac arrest. It consists of thoracic compression (vital for the perfusion of imperative organs) and rescue breathing [3]. The improvement in OHCA survival is influenced by the early recognition and high quality of cardiopulmonary resuscitation-artificial external defibrillator provided (CPR-AED) [4]. In providing quality CPR-AED, strategies to increase the proportion and quality of people trained in CPR is required [5]. Increasing the number and quality of trained people is expected to reduce the gap between CPR knowledge and skills and promote survival rate increase and patient safety.

Several training programs have been conducted for laypeople, health professionals, and students using various teaching methods. By focusing on student populations, a study incorporates a lecture method and adding high-fidelity simulators in the training program, which resulted in significant differences in favor of both the acquisition and retention of knowledge and skills over time [6]. In another study with a one-day program involving theoretical knowledge and a practical session, an immediate significant effect on the knowledge, self-efficacy, and chest compression skill was reported; however, the effect was observed to decline at three months post-training except for the skill of chest compression [7].

Innovations in the learning process, including training programs, can be developed to improve learning outcomes. Online BLS training conducted by Tobase (2017) reported that the methods likely enhance learning and self-efficacy at BLS providers [8]. A qualitative study that evaluated web-based video and feedback in teaching CPR reported that the model provided repeated viewing opportunities to evaluate the good and the bad about their practice, thus making them more confident [9]. However, the online environment also presents challenges for some academic staff [10], requiring a good internet connection and learning culture.

COVID-19 pandemic has an impact on all aspects, including health, economics, and education. In education, specifically about training, the pandemic forces creativity in organizing training while still adhering to health protocols, such as maintaining the distance between students. It is recommended to combine alternative teaching technologies and traditional full-time education, including distance learning in electronic environments [11]. A blended learning model combining face to face models with online learning might be a solution in implementing training. A study that consolidates video-assisted online resources has proven valuable in teaching clinical skills to health students, including nurses [12]. In another study, it was reported that a blended learning approach medical study, including web-based virtual patients and standard pediatric basic life support (PBLs) training, showed significant results on adherence to algorithms and procedural quality of PBLs [13].

Although blended learning has started to be discussed in several studies, there are no studies that discussed the context of BLS training through a systematic review. It is necessary to explore more about blended learning in BLS training models and its implications in nursing students. Therefore, this study explores the effectiveness of blended learning of BLS training and the implications in nursing students. The research questions are: (a) What are the blended learning implement in BLS training? (b) What is the effectiveness of BLS in nursing student populations?

2. Methods

2.1. Research sources

A systematic review (SR) was used five databases, including PubMed, CINAHL, Embase, Web of Science, and Cochrane. This study also checked other sources; however, none of the articles was found.

2.2. Research strategies

The following computerized researches were then performed on all databases using keywords “nursing students” or “health students”, or “students” AND “basic life support”, or “BLS” or “cardiopulmonary resuscitation” or “CPR” AND “blended learning” or “blended education” or “online” or “integrated” or “combination learning” or “mixed-mode instruction”. To combine the keywords, Boolean operators “AND” and “OR” were applied.

Inclusion and exclusion criteria in this study followed: (1) nursing students’ populations, (2) published in full English paper, (4) limitations in 10 years’ articles, and (5) blended study in the course / non-training program are excluded.

2.3. Quality appraisal

This study used Consolidated Standards of Reporting Trials criteria to assess the quality of studies trials, with only studies evaluated at either a medium or high level (Consolidated Standards of Reporting Trials score of 11 or higher) used to enhance the generalization of results [14]. Two review authors (MM and RTM) have independently assessed among studies, including relevance, inclusion, and methodological quality. Each difference is illuminated by the discourse and repetition of method notes.

2.4. Search outcome

This review used the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) statement and followed all stages [15]. Initially, we identified 240 potentially relevant articles in the five databases. With Endnote software, we removed 75 because they are duplicates. With the remaining 165 articles, we conducted screening for the title and abstract, which yielded 21 remaining full-text articles ready for further assessment for eligibility. During the final screening stage, 15 studies were excluded for some reasons (i.e., the inclusion of non-nursing studies populations, not published in the English language, non-blended learning, and non-training program). Finally, six studies were included in this research review (Figure 1).

2.5. Data extraction and synthesis

Included studies were extracted into eight main categories: (a) Author, Country and years, (b) Aim, (c) Research design, (d) blended learning, (e) Sample, (f) Training duration, (g) Key findings, (h) Quality appraisal. A narrative synthesis was used in this review by summarizing the tables and results.

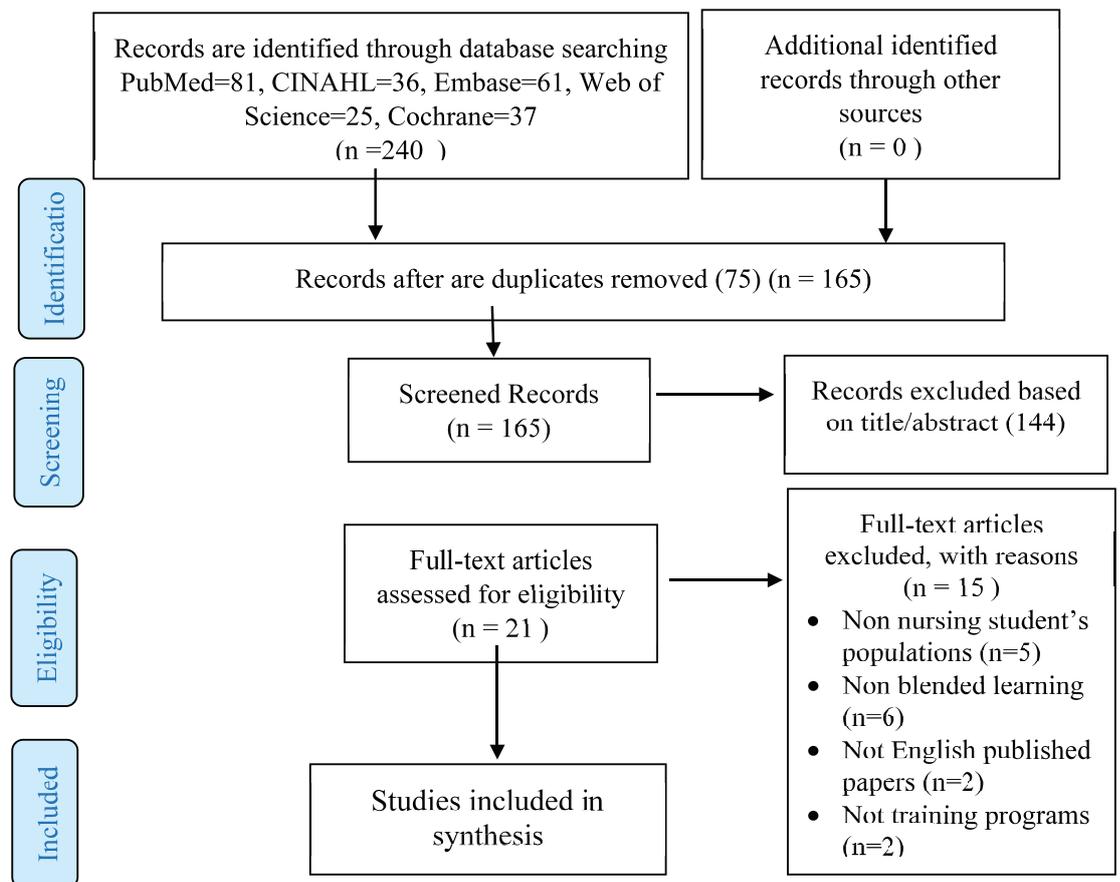


Figure 1: Flow chart of the article selection process

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3. Results

3.1. Characteristics of studies

A total of six studies included in this review are summarized in Table 1. Three of the studies have been conducted in Spain [16, 17], two in South Korea [18-20], and one was in the Russian Federation [21]. The number of participants included was ranged from 79

to 213. In this review, limiting articles published in the last ten years, interestingly, the articles' results in this study were found in 2014-2019.

From a methodological point of view, the three studies used a prospective randomized study design (Castilo, 2018; Castilo, 2019; Birkun, 2019), Randomized Controlled Trial (Moon, 2019), One-group, pretest/posttest, quasi-experimental study design (Park, 2019), and nonequivalent control group posttest-only design (Sook, 2014). To measure the sample's effectiveness in the control and intervention groups used the G * Power Program (Sook, 2014; Park, 2019; Moon, 2019) and the statistical software GRANMO (Castilo, 2019; Castilo, 2018).

3.2. Blended learning intervention models

Consistent with the aims, this review explored the effectiveness of blended learning of BLS training in nursing student populations. Blended learning is defined as integrating face-to-face interaction and innovatively interceded interaction between students in structures and learning resources [22]. The findings of the review which explored blended learning including face-to-face or traditional teaching methods that were integrated with the e-learning website [16, 19, 21], video-based [18], a computer-based simulation [20], and one study was economics analyzed between blended and classical or face-to-face [17].

3.3. Outcome Assessment

Several studies evaluated the effectiveness of blended learning at BLS by assessing several individual aspects, including knowledge and skills as outcomes. Some studies were evaluated knowledge [16, 18, 21], self- efficacy [18-20], problem-solving [19], attitude [18], willingness to attempt resuscitation [21], post-code stress [20], satisfaction with simulation [20], and almost all evaluated the psychomotor skill [16, 19-21]. Table 1 presents the key outcome of blended learning in BLS training among nursing students.

3.4. Quality review assessment

Five of six studies were identified at medium to high quality, with range point from 11-22. Table 1 presents the score of the included study.

TABLE 1: Blended learning of BLS training among nursing students

Authors Year, Country	Aim (s)	Research Design	Blended learning	Sample	Training Duration	Key findings	Quality appraisal
Castillo, 2018, Spain	To compare the standard or blended methods of efficacy on basic life support (BLS) and automatic external defibrillation (AED) training at immediate and 6-month post-training	Prospective randomized experimental study comparing a control group (face-to-face training) and an experimental group (blended training)	Blended learning: <ul style="list-style-type: none"> all students have individual laptops to complete the initial knowledge assessment, and online theory classes can be learned through a virtual Moodle platform and a particular website Each group consists of eight students, given a series of high-quality manikin with feedback, the AED trainer. The last step is to provide 45 minutes' instructor time to clarify doubts and correct or resolve some practical cases. 	178 enrolled students (69 in nursing and 109 in medicine).	1 Day	<ul style="list-style-type: none"> Immediately after training: in knowledge evaluation was reported no statistically significant difference between the two groups; interestingly, in practical, the blended method showed significantly better skill After six months of training: the scores in knowledge and skill performance were significantly lower than immediate evaluation; however, the blended method's skill was better than control groups. 	17
Castillo, 2019, Spain	To identify the cost efficiency between blended and classical or face-to-face BLS training methodology in university	The perspective of the economic analysis	The experimental group received all training with virtual methodology, except for the last 45 minutes an instructor was present face-to-face to deliver the course.	160 nursing and medical students	435 Minutes	The blended-learning methodology was reported to save more cost in the BLS-AED course compared to the face-to-face methodology.	11
Moon, 2019, South Korea	To identify the effectiveness of blended learning CPR education that integrates e-learning and face-to-face education effectively improves nursing students' knowledge, attitude, and self-efficacy.	Randomized Controlled Trial	Blended method: <ul style="list-style-type: none"> Video session (60'): introduction, interaction with all participant, motivation Video session (30'): learning about chest compression and how to use an AED Video session (50'): learning about standard CPR education program Face to face lecture (90'): the detail of steps CPR 	120 nursing students	230 Minutes	A blended learning CPR program that integrated videos and face to face lecture was reported to improve nursing students' knowledge and emotional attitudes regarding CPR.	22

TABLE 1: Continued

Authors Year, Country	Aim (s)	Research Design	Blended learning	Sample	Training Duration	Key findings	Quality appraisal
Park, 2016, South Korea	Identifying the educational effects of blended e-learning on self-efficacy, problem-solving, and psychomotor skills for nursing practice related to cardiopulmonary resuscitation and defibrillation.	One-group, pretest/posttest, quasi experimental study design	Blended e-learning: Participants follow 2 weeks of lecture-based conventional practice, in addition to an average of 60 minutes at least twice a week via self-contained e-learning for basic CPR and defibrillation.	79 nursing students	240 Minutes in 2 weeks	<ul style="list-style-type: none"> Blended e-learning group: have improved problem-solving abilities and self-efficacy for nursing practice related to cardiopulmonary resuscitation and defibrillation An 80% to 90% intervention group have increased psychomotor skills 	Non applicable
Young Sook 2014, South Korea	To identify the effects of computer-based simulation plus instructor-led cardiopulmonary resuscitation training on nursing students' performance, self-efficacy, post-code stress, and satisfaction.	Nonequivalent control group posttest-only design	Blended learning: <ul style="list-style-type: none"> Trainees study in computer labs to complete the heart attack module and are guided by faculty members Faculty members provide verbal directions on how to use and complete the modules, and each nursing student performs individual resuscitation skills to assess and treat patients with cardiac arrest caused by ventricular fibrillation Computer-based simulation is used as self-contained resuscitation training before simulation testing sessions 	213 nursing students	1 weeks	Blended learning: computer-based simulations combined with hands-on practice had higher nursing student performance scores than the control group, but no statistical differences between them.	19
Birkun, 2019, Russian Federation	To compare the effectiveness of blended learning and traditional full-time study of basic CPR using an automatic external defibrillator (AED) and evaluate CPR knowledge and willingness to attempt resuscitation	Prospective randomized study	Traditional methods: underwent classroom training (1 hour of lecture, 3 hours of hands-on training) Blended training (1 hour of on-line course, 3 hours of hands-on training) in basic CPR with automated external defibrillation (AED)	94 participants (nursing students and non-medical university students)	4 hours	<ul style="list-style-type: none"> There were increased willingness to perform resuscitation (from 3.6 to 4.4 points in both groups) and self-perceived CPR knowledge (from 2.4 to 4.0 points in the classroom training group and from 2.6 to 4.3 in the blended group training class). In the simulated scenario, the quality of CPR showed no significant difference between groups, except for a higher rate of chest compressions in the blended training group 	14

4. Discussion

The first blended learning model in this review's findings is an integrated face to face with e-learning website. In addition to 45 minutes of face-to-face instructors, online learning is used for initial assessment of the knowledge, and for learning theory, it also provides a Moodle platform and a special website [16]. A study conducted a short 2-week training session based on conventional lectures, combined with independent online learning with an average of 60 minutes at least twice a week about basic CPR and defibrillation [19]. Another study applied blended training (one hour of an online course, three hours of hands-on training) of basic CPR with AED [21]. Two studies were reported to have significant skills improvement from these models, which were evaluated immediately after blended training [16, 19]. Furthermore, skills in blended learning are reported to be better than the control group after six months of training [16]. One study reported a higher level of chest compression in the blended training group than in the control group; however, there was no statistical difference in the simulation scenario's CPR quality [21].

Besides skills, knowledge, attitudes, and self-efficacy are often assessed after training. Self-perceived CPR knowledge, and willingness to perform resuscitation are increased after training [21], a study reported increased problem-solving abilities and self-efficacy for nursing practice [19]. In contrast, one study reported no statistically significant difference in the evaluation of knowledge between face-to-face and blended learning groups immediately after training [16].

The second blended learning model in the findings of this review is integrated face to face with video-based. A study by Moon (2019) conducted in South Korea, was identified of blended learning CPR program that integrated videos and face to face lecture. This study's findings have been proven to be effective in increasing the knowledge and attitudes of nursing students regarding CPR after receiving a blended learning video program and face-to-face lectures [18]. An integrative review of blended learning video resources reported that this model is very useful in improving students' knowledge and skills, and preferred more by students because of its flexibility [12].

The third blended learning model in this review is integrated face to face with a computer-based simulation. A study by Young Sook (2014) about blended learning was integrated traditional and a computer-based simulation. This program requires the trainees to be mentored by faculty members to the computer lab to complete a cardiac arrest module, be given verbal instruction on how to use and complete the modules, and each of the nursing student trainees performs individual resuscitation skills to assess

and manage a cardiac arrest patient caused by ventricular fibrillation. The results of this study computer-based simulation combined with hands-on practice have higher score of nursing students' performance, however no statistical s difference of both groups [20].

A recent study was evaluated whether the blended-learning methodology is more efficient than the classical or face-to-face methodology. Online methodology combined with 45 minutes of instructor face-to-face time, allows for significant cost savings compared to conventional face-to-face methods only [17].

This BLS training is very important to improve knowledge and skills and increase efforts to balance the two. Blended learning has become one of the solutions with several review results that show the effectiveness of increasing knowledge and skills after training. These models answer the current challenges of providing quality instruction and training while following the COVID-19 protocol of minimizing face-to-face interaction, and limiting the number of people gathered.

In summary, several blended learning incorporate face to face learning with e-learning website, video based and a computer-based simulation. Blended learning has proven effectiveness in nursing students' populations, including skills, knowledge, attitudes, self-efficacy, problem-solving abilities, and willingness to perform resuscitation. Psychomotor skill was improved after training, specifically in e-learning website, and a computer-based simulation. Self-perceived CPR knowledge, problem-solving abilities, self-efficacy for nursing practice and willingness to perform resuscitation were improved after training used blended training with the e-learning website. Furthermore, nursing students' knowledge and attitudes regarding CPR were improved after receiving a blended learning video program. However, one study still reported no statistical difference from the two computer-based simulation groups combined with direct practice, but the intervention group had higher nursing student performance scores. With the limited blended learning conducted in BLS training for nursing students, this review consistently reports on this training model's effectiveness.

Limitations

This study included all studies which answered the research questions. However, this review includes a quasi-experimental study design (Non applicable appraisal used Consort) due to the limited number of studies available and the importance of information obtained from blended learning interventions [19]. Interestingly, one study assessed an economic analysis perspective that can help illustrate the effectiveness of blended

learning. Despite these limitations, this review provides information about blended learning that give implications in nursing studies populations.

5. Conclusions

Pandemic COVID- 19 situations, providing opportunities for active learning and creative training, especially BLS. Three models of blended learning, namely, incorporate face-to-face learning with an e-learning website, video-based, and a computer-based simulation, were found in this study. Blended learning shows its effectiveness in increasing self-knowledge of CPR, solving problems, self-efficacy for nursing practice, willingness to do resuscitation, and skills in the nursing student population. Both blended learning models have effective in increasing self-knowledge of CPR; furthermore, blended learning incorporated an e-learning website, and a computer-based simulation was reported effective in skill among nursing students.

Using blended learning in BLS training while adhering to health protocols may be useful in increasing knowledge and skills so that it contributes to increasing the level of survival and patient safety. Future BLS training need to include blended learning by modifying the training modules while still adjusting each campus or school's capabilities in terms of human resources or the equipment needed.

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Conflict of Interest

There are no conflicts of interest.

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