BMC Medical Education

RESEARCH

Open Access

The effects of personalized video feedback of basic cardiac life support on knowledge and skills levels in undergraduate nursing students: a randomized controlled trial

Habibeh Mohsenzadeh[1], Zahra Farsi[2] and Effat Afaghi[1*]

Abstract

Background Cardiopulmonary cerebral resuscitation is the first-line treatment for cardiopulmonary arrest, documented as one of the most common medical emergencies and the leading causes of death globally. The aim of this study was to investigate the effects of the personalized video feedback of Basic Cardiac Life Support (BCLS) on knowledge and skill levels among undergraduate nursing students.

Methods This randomized controlled trial was conducted at a nursing school in Tehran, Iran, in 2023. Forty incoming students were chosen through the census method and divided into experimental and control groups by simple randomization. The students of both groups were taught about BCLS through lectures and simulation-based techniques in two 120-minute sessions. Then, the students performed BCLS on the mannequin and recorded it with a digital camera, then immediate personalized feedback was given in both groups. Next, the recorded video with personalized feedback from the experimental group was made available to them that it was the only difference between the two groups. One week and one month after retraining, the BCLS knowledge and skills levels of both groups were examined. To collect the data, the personal profile form, the BCLS knowledge questionnaire, and the BCLS skills Checklist were utilized.

Results There was no significant difference in the individual characteristics ($p > 0.05$) and the mean scores of BCLS knowledge ($p = 0.762$) and skills ($p = 0.715$) in both groups before training. There was no significant difference in the mean scores of BCLS knowledge in both groups immediately ($p = 0.467$), one week ($p = 0.904$), and one month ($p = 0.626$) after training. No significant difference was observed in the mean scores of BCLS skills in both groups immediately after training ($p = 0.303$), while one week ($p < 0.0001$) and one month ($p < 0.0001$) later, the mean skills scores in the experimental group were higher than those in the control group.

Conclusions Providing feedback to students via personalized video appears to have a greater impact on students' knowledge and skills regarding BCLS than providing in-person feedback alone. So, it was recommended to apply this student-centered and self-directed training in undergraduate nursing students after more studies in larger groups.

*Correspondence:
Effat Afaghi
afaghi8181@gmail.com

Full list of author information is available at the end of the article

Trial registration The study has been registered in the Iranian Registry of Clinical Trials (No. IRCT20230911059402N1, Date: 12/10/2023).

Keywords Feedback, Video, Cardiopulmonary cerebral resuscitation, Basic cardio life support, Knowledge, Skill, Students, Nursing, Simulation

Background

Cardiopulmonary arrest (CPA) has been documented as one of the most common medical emergencies and the top causes of mortality across the world [1]. Each year, over 356,000 individuals in the United States have an out-of-hospital CPA [2], and about 60–80% of cases lose their lives before reaching healthcare facilities [3]. In this context, the primary treatment for CPA is cardiopulmonary cerebral resuscitation (CPCR) [4], as a life-saving technique, to establish blood flow and oxygenation during this condition [5, 6]. CPCR involves basic and advanced cardiopulmonary life support (also called BCLS and ACLS) [7]. The BCLS contains the practice of cardiac massage, chest compressions, artificial ventilation, and the application of a defibrillator [6], while the ACLS refers to the administration of drugs, ventilation, intubation, and intravenous fluid therapy [8].

Given the utmost importance of CPCR in patients with CPA, initiating this first-aid procedure as fast as possible thus increases the chance of success up to 90% [9]. Even though over 40 years have passed since the introduction of CPCR, the death rate caused by CPA is still high [10, 11].

The success rate of CPCR and saving a patient's life largely depends on the knowledge levels and skills of those present at the scene or the patient's bedside [10]. Annually, millions of individuals receive training in BCLS and ACLS to promote care quality for patients with CPA [12]. Notably, there are many factors affecting the failure of this procedure, such as delay in the launch of CPCR, insufficient knowledge and skills, no expertise regarding the standards of applying shocks and administering different drugs, and improper speed of its practice [13]. Furthermore, the knowledge and skill levels of the individuals trained for this purpose dwindle after some time, and they need to update the previously learned materials [14, 15]. As an example, Chandrasekaran et al. found that no medical, dental, or nursing students had complete knowledge of BCLS and only 19% had obtained scores of 80–89 (high), 95% of the cases had scored 70–79 (moderate), and the knowledge levels of the majority (84.8%) was below 50 (low) [16]. According to Akhlaghdoost et al., just 10.9% of medical students had been subjected to CPCR skills and none had received formal training, as their knowledge mean scores were 11.93 ± 2.87 (range: 10.13–17.25) [17]. Given such evidence, regular theoretical and practical CPCR training courses should be thus held for all healthcare providers, including physicians, nurses, general practitioners, specialists in various fields, nursing interns, and medical assistants, and their knowledge and skills before and after such courses should be measured by the right techniques [10, 15].

The shortcomings of traditional training methods regarding CPCR highlight the significance of employing novel approaches and teaching methods such as online courses, serious games, multimedia, modeling, simulation, and educational aids to improve CPCR knowledge levels and skills and ultimately reach better in-depth learning [12, 15, 17].

The simulation method is where the trainees act out a clinical scenario while engaging in problem-solving and decision-making [20]. As a training method, simulation reproduces a real clinical setting, in which some techniques such as role-playing and educational aids, e.g., educational videos and moulage, are utilized to boost critical thinking in students [21]. Simulation-based education includes computer-based virtual environments, high-fidelity mannequins, task trainers, and standardized patients [20]. So it has been exploited as one of the main strategies in many universities in recent years [18]. On the other hand, feedback is known as one of the basic components of the learning process during simulation, and the main objective of clinical feedback is to provide specific information by comparing overall performance with a predetermined standard for its improvement [21]. Effective feedback thus enables students to actively engage in the learning process, understand the intended goals, and improve their competency by evaluating their skills against some preset objectives [22].

The personalized video feedback (PVF) training also includes audio and visual elements, used as an alternative to deal with the limitations of text and voice in written feedback thanks to its multifaceted nature [23]. Students can accordingly identify what they have done correctly or incorrectly and what skills they need to improve once the PVF is employed in teaching nursing skills [24]. As evidenced, instructors go into detail and reflect on specific points to provide constructive conceptual feedback on reasoning, information analysis, and further judgment when the PVF is utilized [25]. In addition to reinforcing the positive aspects of one's skills, watching enhances students' motivation and learning success. In this way, they can view their previous skill sets [26]. Although Yigit et al., confirmed the effects of the PVF on promoting students' virtual learning in Turkey [27], Vondel et al., reported that such feedback did not affect students'

knowledge levels in the Netherlands [28]. As well, McCutcheon et al., established that using video-based and theoretical training simultaneously was more effective than video-based training alone [29].

Considering the importance of recruiting efficient healthcare providers, particularly qualified nurses to practice BCLS, improving BCLS skills among nursing students to save patients' lives, as well as using the PVF training as a student-centered and self-directed training approach with conflicting evidence regarding its effectiveness, this study aimed to investigate the effects of the PVF of BCLS on the knowledge and skills levels of undergraduate nursing students at a nursing school.

Aim This study aimed to investigate the effect of the personalized video feedback of BCLS on the knowledge and skill levels of undergraduate nursing students.

Hypothesis

We expected the PVF of BCLS to improve the knowledge and skill levels of undergraduate nursing students in comparison with standard CPCR without PVF.

Methods

Design and setting

This randomized controlled trial, listed on the Iranian Registry of Clinical Trials (No. IRCT20230911059402N1, Date: 12/10/2023), was conducted in a nursing school in Tehran, Iran, in 2023.

Participants and sample size

The inclusion criteria were being an incoming students, not being exposed to CPCR over the last six months, not working in healthcare centers, and obtaining a score of less than 10 from the BCLS knowledge questionnaire and the BCLS Skills Checklist. The exclusion criteria were missing one session of the CPCR training course, suffering from problems limiting their physical performance, and showing unwillingness to continue cooperation in the study. Considering the effect size (ES) of 0.7, the type-I error (α) equal to 0.05, and the type-II error (β) of 10%, the sample size was further determined using G*Power as 34 nursing students. Given the probability of 20% sample loss, 40 students (20 in each group) were recruited into the study using the census method and then assigned into experimental and control groups by simple random sampling through coin flipping. Random allocation was performed by a research assistant who was not aware of the study groups. Also, the students did not know whether they were in the experimental or the control group.

Intervention

Firstly, the educational content was prepared by the researchers using the 2020 American Heart Association Guidelines for CPCR and other up-to-date literature about BCLS and CPCR. Upon being approved by researchers and 10 academic staff members at a school of nursing, the content was formatted in Microsoft PowerPoint.

After explaining the study objectives and procedure and then obtaining written informed consent, the students were included in the study. The personal profile form (PSF), the BCLS knowledge questionnaire, and the BCLS Skills Checklist were subsequently completed by the experimental and control groups.

Following the pre-test, the first researcher, trained for this purpose, presented the theoretical content of BCLS via lectures and question-and-answer during a 120-minute session using Microsoft PowerPoint and an educational video to both groups. Also, CPCR skills were taught by simulation-based techniques and using a simulated CPCR mannequin within a 120-minute session to the experimental and control groups of students in the skill lab of the nursing school.

Afterward, the nursing students were required to perform BCLS on the simulated CPCR mannequin as soon as the training was completed. By creating small groups of seven, CPCR was thus practiced on a torso model simulated CPCR mannequin based on a scenario and recorded by a digital camera. Immediate feedback was then given by the researcher individually to all students of both groups and then the BCLS knowledge questionnaire was completed by the nursing students. Along with immediate feedback to the experimental group, the researcher watched the practice video of each student and recorded the feedback regarding the strengths, weaknesses, mistakes, and corrections in detail to help students view their skills and improve them.

Then, the researcher gave a video of each student with personalized feedback to those in the experimental group. One week and one month after training, the BCLS knowledge questionnaire, and the BCLS Skills Checklist were completed.

At the end of the study, the personalized video of the students in the control group was also made available to them. During the study, one nursing student in the control group was excluded from the study due to withdrawal from education. The study process is illustrated in Fig. 1.

Data collection

To collect the data, the PSF, the BCLS knowledge questionnaire, and the BCLS Skills Checklist were used. The PSF contained items about age, marital status, Iran's National University Entrance Examination score (the admission system in Iran is based on high school graduates ranking in this exam [30]), living in the dormitory, a history of CPCR theoretical and practical training,

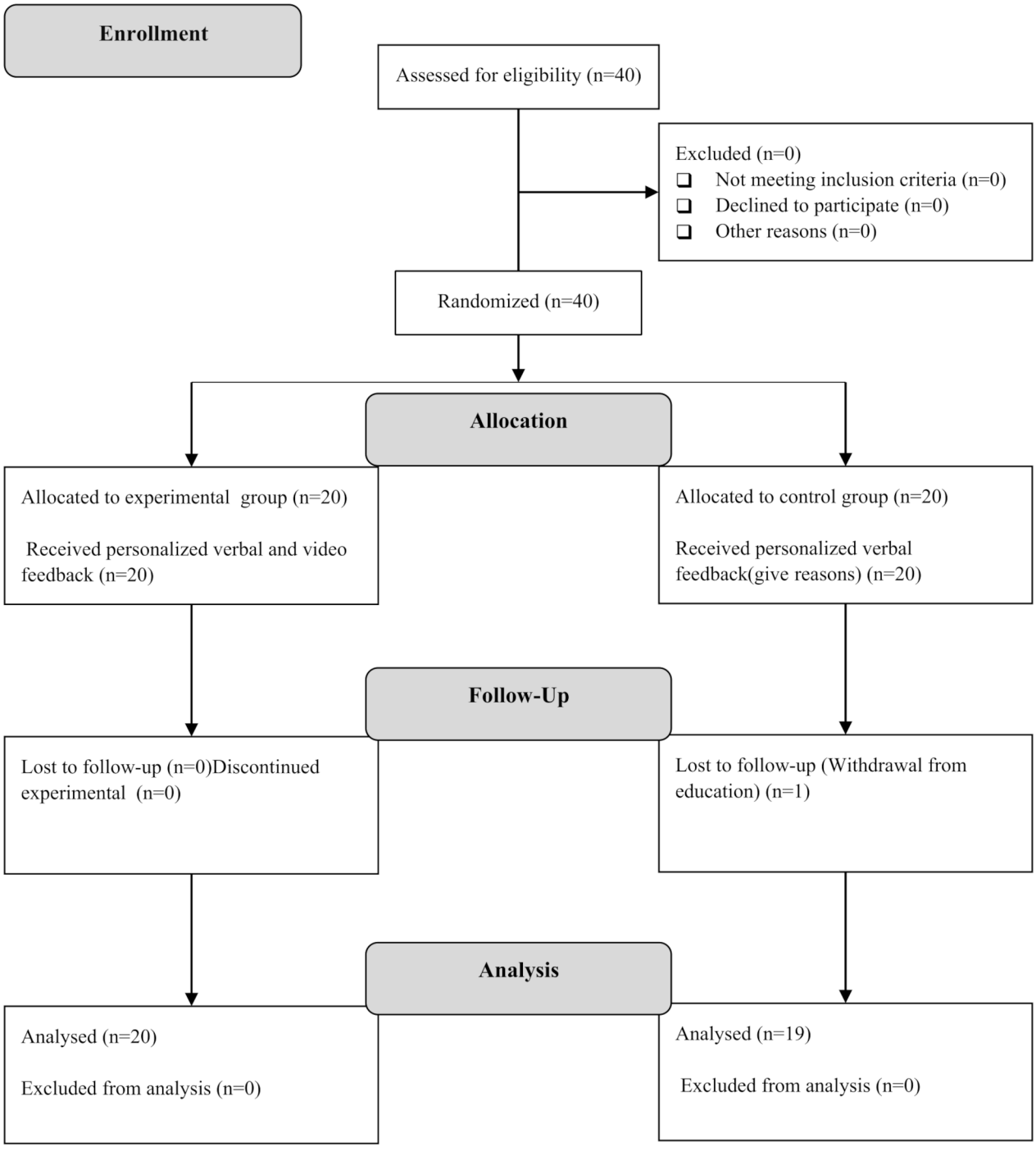

Fig. 1 The process of the study

clinical work experience as an emergency care assistant and paramedic, as well as a history of practical exposure to CPCR, which was completed by the students in both groups.

Then, the BCLS knowledge questionnaire and the BCLS Skills Checklist were utilized [31] and then updated based on the 2020 American Heart Association Guidelines for CPCR.

The BCLS knowledge questionnaire contained 20 items four-choice ones. The first four items measured the level of recall in the students based on Bloom's taxonomy and the rest measured their levels of understanding and

application based on Bloom's taxonomy as a scenario. One point was thus given to the correct answer to each question and zero was considered for the incorrect answers. The range of scores was between 0 and 20. The level of knowledge was classified as low = 0–9, moderate = 10–15, and high = 16–20.

The BCLS Skills Checklist also consisted of 30 items to measure BCLS skills. Its items were evaluated in a dichotomous method (right = 1 and wrong = 0). The range of scores on the checklist was between 0 and 30. The level of skills was classified as low = 0–9, moderate = 10–20, and high = 21–30.

Abdi et al., have already confirmed the face and qualitative validity of the BCLS knowledge questionnaire and the BCLS Skills Checklist. Besides, the reliability of the BCLS knowledge questionnaire had been established by the test-retest method ($r = 0.86$) and internal consistency using Cronbach's alpha ($\alpha = 0.8$). Abdi et al. also reported the reliability of the BCLS skills checklist concerning the interrater kappa statistic of 93% [31].

In this study, to verify the face validity of the BCLS knowledge questionnaire and the BCLS skills checklist, they were given to 20 fourth-year nursing students at Shiraz University of Medical Sciences, Shiraz, Iran, and then the difficulty, relevance, and ambiguity of their items and the inadequacy of the meanings of their words and statements were examined and revised if needed. To achieve content validity, both questionnaires were submitted to 10 academic staff members in the Department of Critical Care Nursing at Aja University of Medical Sciences, Tehran, Iran, and Shiraz University of Medical Sciences, Shiraz, Iran. Finally, the necessary suggestions and modifications were collected and applied upon the approval of the research team and the validity of the tools was reconfirmed. In this study, the reliability of the BCLS knowledge questionnaire was based on the test-retest method ($r = 0.89$) and Cronbach's alpha ($\alpha = 0.64$), and the reliability of the BCLS skills checklist concerning the interrater kappa statistic was 91%.

Data analysis

The data were analyzed using the Statistical Package for the Social Sciences (SPSS) software, version 22. The descriptive (e.g., mean, standard deviation (SD), frequency, and percentage) and inferential statistics were utilized. The Kolmogorov-Smirnov test was also tapped to check the normality of the data. Then, parametric tests, such as the independent-samples *t*-test, and RM-ANOVA were used to analyze the normality of the quantitative data, considering the significance level of $p < 0.05$. The ESs are considered as small ($d = 0.2$), medium ($d = 0.5$), and large ($d \geq 0.8$) [32]. The statistical analyst was unaware of the allocation of students to the experimental and control groups.

Results

The 40 incoming students included in this study were female. They were also living in the dormitory, had no clinical work experience, had not been exposed to CPCR, and had received no theoretical and practical training in this field. Examining their characteristics further revealed that both groups had no statistically significant difference in terms of age ($p = 0.275$), high school diploma grade point average ($p = 0.960$), and Iran's National University Entrance Examination score ($p = 0.821$) (Table 1).

Moreover, there was no significant difference in the BCLS knowledge mean scores among the students before training in the experimental and control groups ($p = 0.762$). No significant difference was also spotted in the BCLS knowledge mean values of the nursing students in both groups immediately ($p = 0.467$), one week ($p = 0.904$), and one month ($p = 0.626$) after training. However, the BCLS knowledge mean scores of the students in both groups had an upward trend immediately, one week, and one month after training ($p < 0.001$))Fig. 2(. The ES of the PVF of BCLS on students' knowledge level was 0.88 (Table 2).

The BCLS skills mean scores before ($p = 0.715$) and immediately after training ($p = 0.303$) in the experimental and control groups further demonstrated no significant difference, while one week ($p < 0.0001$) and one month ($p < 0.0001$) after training, the mean scores in the experimental group were higher than those in the control group. In both groups, the BCLS skills mean values of the nursing students had an ascending trend immediately, one week, and one month after training ($p < 0.001$))Fig. 3(. As well, the ES of the PVF of BCLS on the students' skills was 0.92 (Table 3).

Table 1 Individual characteristics of nursing undergraduate students in experimental and control groups

Variable	Group		Independent Samples t-Test	df	*P*-value
	Experimental Mean (SD)	Control Mean (SD)			
Age, year	19.55 (1.05)	19.10 (1.49)	-1.107	38	0.275
High school diploma grade point average	19.30 (0.30)	19.29 (0.50)	-0.050	38	0.960
Iran's National University Entrance Examination score	8229 (273.36)	8204.6 (394.66)	-0.227	38	0.821

SD: standard deviation

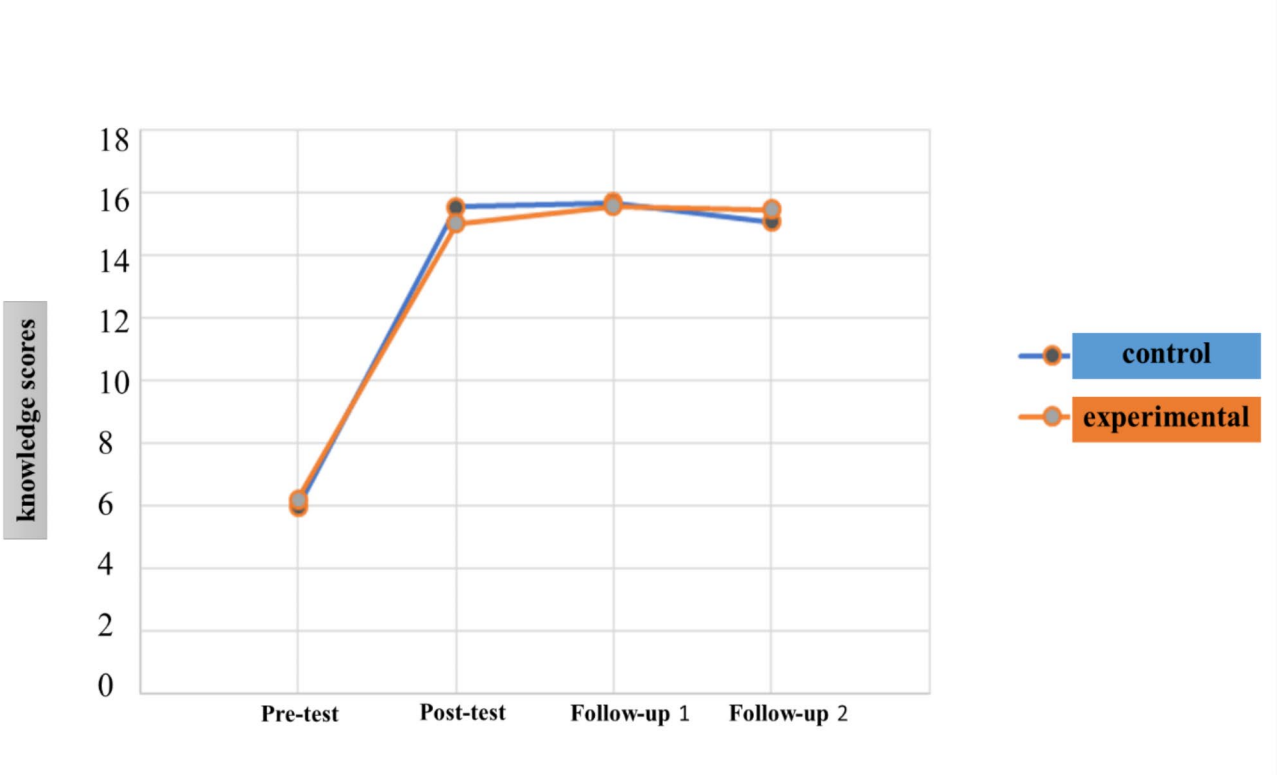

Fig. 2 Comparison chart of BCLS knowledge scores of undergraduate nursing students before and after training in the experimental and control groups

Table 2 Comparison of mean and standard deviation of BCLS knowledge scores of undergraduate nursing students before and after training in the experimental and control groups

Group Time	Experimental Mean (SD)	Control Mean (SD)	Independent Samples t-Test	df	*P*-value
Pre-test	6.20 (2.31)	5.96(2.86)	t= -0.304	38	0.762
Post-test	15.00(2.27)	15.53(2.20)	t-= 0.735	37	0 0.467
Follow-up 1	15.55(2.87)	15.65(2.28)	t = 0.122	38	0.904
Follow-up 2	15.45(2.16)	15.05(2.86)	t= -0.491	37	0.626
RM-ANOVA Mauchly's W	F = 120.522 df = 1.986 *P* < 0.0001	F = 168.028 df = 2.044 *P* < 0.0001			
ES	Partial Eta Squared = 0.883				

SD: Standard Deviation, ES: Effect Size

Discussion

This study aimed to investigate the effects of the PVF of BCLS on the knowledge and skill levels of undergraduate nursing students. The research hypotheses were confirmed. Both experimental and control groups accordingly showed no significant difference in terms of individual characteristics, viz., they were homogeneous. Before training, the BCLS knowledge and skills mean scores between both groups did not have a statistically significant difference, and they were low (below 10), similar to those reported in Demirtas et al., researching the effectiveness of simulated CPCR training programs for fourth-year nursing students. They further found that the mean values of knowledge and skills levels before CPCR training by simulation had been low, and no statistically significant difference had been observed between both groups before training [33]. One of the inclusion criteria in the present study was not having any formal CPCR training. Also, the students of both groups had not yet completed the course titled Emergency Nursing in Crises and Unexpected Events at the time of the study; they did not have clinical work experience and were not familiar with BCLS. Overall, the low pre-test scores indicated that the BCLS knowledge of the first-year nursing students was not enough in a way that the increase in the scores after training indicated its effectiveness.

The study findings additionally demonstrated that the BCLS knowledge mean scores augmented in the

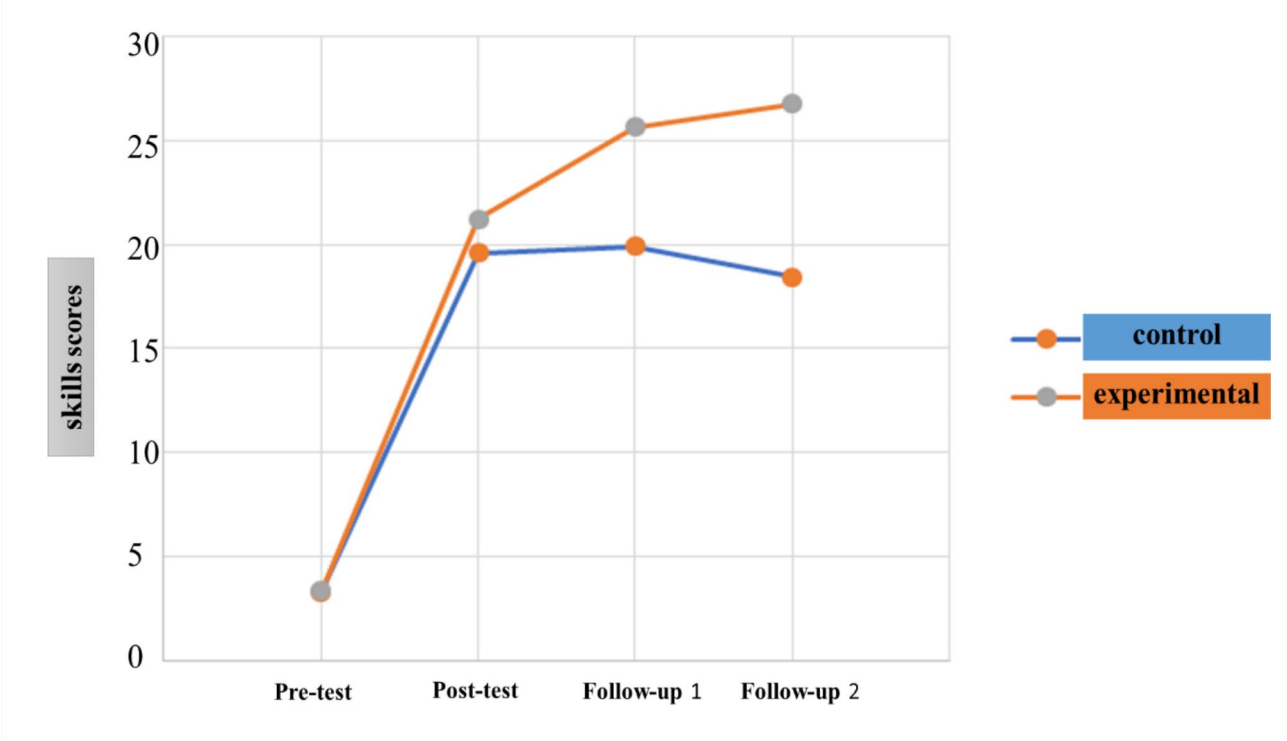

Fig. 3 Comparison chart of BCLS skills scores of undergraduate nursing students before and after training in the experimental and control group

Table 3 Comparison of the mean and standard deviation of BCLS skills scores of undergraduate nursing students before and after training in the experimental and control groups

Group Time	Experimental Mean (SD)	Control Mean (SD)	Independent Samples t-Test	df	*P*-value
Pre-test	3.45(1.23)	3.25(2.1)	t= -0.367	38	0.715
Post-test	20.75(5.04)	19.05(5.27)	t= -1.043	38	0.303
Follow-up 1	25.63(4.22)	19.50(4.35)	t= -4.466	37	$P<0.0001$
Follow-up 2	26.25(4.27)	18.42(5.50)	t= -4.982	37	$P<0.0001$
RM-ANOVA Mauchly's W	F = 313.479 df = 2.271 $P<0.0001$	F = 138.260 df = 3 $P<0.0001$			
ES	Partial Eta Squared = 0.920				

SD: standard deviation, ES: effect size

experimental and control groups, immediately, one week, and one month after training. However, no statistically significant difference was also seen in all three intervals. Providing the PVF in addition to immediate feedback in the experimental group thus seemed to have an impact on raising the students' knowledge levels in BCLS, but the intensity of the effect is not so great that there is a significant difference in the scores of the two groups. The ES of the PVF of BCLS on students' knowledge level was at a high level. In this regard, Yigit et al., found that video feedback was effective in promoting students' virtual learning [27]. On the other hand, Vondel et al. showed that video feedback did not influence knowledge levels [28]. In general, watching a video alone could not have a significant effect on enhancing knowledge levels in students, while after training by lectures and simulation as well as providing immediate face-to-face feedback, knowledge had improved in both groups, which implied the effectiveness of the PVF. The findings correspondingly showed no statistically significant difference between the experimental and control groups in terms of BCLS skills mean scores immediately after training, while one week and one month later, there was a statistically significant difference. The ES of the PVF of BCLS on the students' skills was at a high level. In both groups, the BCLS skills mean scores also increased immediately, one week, and one month after training. Considering that both groups received the same training and the PVF had not yet been provided to the students of the experimental group, the absence of a statistically significant

difference between both groups immediately after training was expected. The statistically significant difference between the BCLS skills mean scores in the experimental and control groups, one week and one month after training, could be accordingly attributed to the effectiveness of the PVF. These findings were consistent with those in Lin et al., in which the effect of video feedback recording on CPCR practical skills of fourth-year medical students was investigated [34]. It was also in line with Ghaderi et al., comparing immediate feedback and review via video recording on BCLS skills in nursing students [19]. Pérez-Segura et al., examining the impact of the PVF on students' listening and reading skills, further established that the given method could improve them [35]. Aljamal et al., further reported that group video feedback training was an effective method to increase skills in surgical interns [36]. Likewise, Kam et al., stated that such a method could effectively enhance clinical skills in students [37]. As well as evidence also showed that the use of automated real-time feedback devices during education can increase the skill and CPCR performance of healthcare providers effectively increasing the quality of life-saving treatment during CPCR and minimizing the risk of injury [38]. However, some limitations and problems such as limited application scenario, a non-intuitive feedback mode, limitations of feedback parameters, and limited contribution to improve chest compression quality remain [39].

Generally, watching more personalized videos seemed to affect students' skills. In this way, they could watch the video as many times as they needed to progress in their learning process and master CPCR. Thanks to the accelerated developments in the use of technologies in education, providing the PVF to students could thus make it easier to access learning at any time and place, and then understand their strengths and weaknesses and improve their skills. This could be the occasion of devoting much attention to educational points and learning consolidation in students. On the other hand, the implementation of this method is recommended to nursing teachers due to its self-directed and universal orientation and special attention to the individual differences of students, which leads to the strengthening of deep learning and reaching the level of mastery of the learners. Further studies are needed to better understand the role of PVF of BCLS on the knowledge and skill levels of undergraduate nursing students.

Limitations

One of the limitations of this study was that all participants were female. Considering that the total number of students at the time of the study was female, it was not possible to include the male ones. It was thus suggested to conduct studies with a larger sample size in both genders in the future. As the training program, provided to the experimental and control groups, was conducted in the same school of nursing, there was a chance of contamination bias between both experimental and control groups. Given that the single difference between the study groups was in the PVF, the videos had individual feedback and each person had their own, so both groups did not know they were in the experimental or control groups. In this study, the participants were students of the first semester who took only theory courses and did not receive any other training in this field. However, students' activities were not studied after initial training and their possible exposure to the CPR process, which may affect the results of the study.

Conclusions

The study results revealed that the PVF was effective in improving BCLS knowledge levels and skills in undergraduate nursing students. Using this student-centered self-directed training approach along with other techniques could thus boost knowledge and skills in the field of clinical procedures such as BCLS. Therefore, it was suggested to use novel training methods such as simulation and provide the PVF to teach courses that require skills development and their use at the bedside. Similar studies on other clinical skills are further recommended.

Abbreviations

CPA	Cardiopulmonary Arrest
CPCR	Cardiopulmonary Cerebral Resuscitation
BCLS	Basic Cardio Life Support
ACLS	Advanced Cardio Life Support
PVF	Personalized Video Feedback
IRCT	Iranian Registry of Clinical Trials
PSF	Personal Profile Form

Acknowledgements

This study was extracted from the Master's Thesis in Critical Care Nursing, which was approved with code No. 555/121 at Aja University of Medical Sciences, Tehran, Iran, on 2023/09/27. The authors hereby extend their gratitude to the officials and instructors of the School of Nursing affiliated with Aja University of Medical Sciences, Tehran, Iran, and appreciate the nursing students for their cooperation.

Author contributions

H.M contributed to the conceptualization, planning, data collection, and writing the initial draft of the manuscript. Z.F was involved in the conceptualization, planning, content production, data analysis, and interpretation, supervision of the study, and critical revision of the manuscript. E.A was involved in the conceptualization, planning, content production, data interpretation, supervision of the study, and critical revision of the manuscript. All authors collaborated in the study and they read and approved the final manuscript.

Funding

Aja University of Medical Sciences will pay the cost.

Data availability

"The datasets used and analyzed during the present study are available from the corresponding author upon reasonable request".

Declarations

Ethics approval and consent to participate
This study was approved by the Ethics Committee of Aja University of Medical Sciences, Tehran, Iran (IR.AJAUMS.REC.1402.121). The ethical considerations addressed in the Declaration of Helsinki, viz., obtaining informed consent, explaining the research objectives and procedure to students, respecting the confidentiality of information from students, having voluntary participation and withdrawal from the study, and complying with the publication rules, were also observed.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

Author details
[1]Instructor, Critical Care Nursing Department, Nursing School, Aja University of Medical Sciences, Kaj St., Shariati St, Tehran, Iran
[2]Research and Ph.D. Nursing Departments, Nursing School, Aja University of Medical Sciences, Tehran, Iran

Received: 13 June 2024 / Accepted: 2 March 2025
Published online: 07 March 2025

References

1. Sopka S, Hahn F, Vogt L, Pears KH, Rossaint R, Rudolph J, et al. Peer video feedback builds basic life support skills: a randomized controlled non-inferiority trial. PLoS ONE. 2021;16(7):e0254923.
2. Benjamin EJ, Virani SS, Callaway CW, Chamberlain AM, Chang AR, Cheng S, et al. Heart disease and stroke statistics—2018 update: a report from the American heart association. Circulation. 2018;137(12):e67–492.
3. Tsao CW, Aday AW, Almarzooq ZI, Alonso A, Beaton AZ, Bittencourt MS, et al. Heart disease and stroke statistics—2022 update: a report from the American heart association. Circulation. 2022;145(8):e153–639.
4. Heidarizadeh K, Bazgiri M, Kordestani-Moghaddam P, Ebrahimzadeh F. Effectiveness of cardiopulmonary resuscitation training on the performance of the resuscitation team based on the Kirkpatrick model. J Nurs Educ (JNE). 2023;12(4):31–43.
5. Mulyadi M, Lee B-O, Malara RT, Bidjuni HJ. The effectiveness of blended learning in basic life support training among nursing students: A systematic review. KnE Life Sci. 2021:402–14.
6. Noori Sanchooli H, Rashki Ghalenow H. Advanced cardiopulmonary resuscitation updates 2020: a narrative review. J Mod Med Inform Sci. 2022;7(4):72–80.
7. Esfahani MN, Javari A, Heydari F, Javari M. Evaluation of effective factors in the success of resuscitation of patients with in-hospital cardiopulmonary arrest. Tehran Univ Med J TUMS Publications. 2022;80(4):313–22.
8. Panday MM, Siva MN, Sharma MK. A study to assess the effectiveness of simulation in terms of knowledge and skill regarding basic life support (BLS) among Non-Medical Faculty.-A narrative review. Int J. 2019;3(1):60–3.
9. Shabannia A, Pirasteh A, Jouhari Z. The effectiveness of cardiopulmonary resuscitation training by mannequin training method and educational video on the awareness of Shahed university staff. Daneshvar Med. 2021;29(4):33–41.
10. Esmaeili Ranjbar F, Ahmadinia H, Rezaeian M, Sanji Rafsanjani M, Gorouhi S, Esmaeili Ranjbar A. Assessment of nurses' awareness of the latest cardiopulmonary resuscitation instructions in Ali Ibn abi Talib hospital in Rafsanjan in 2019: A descriptive study. J Rafsanjan Univ Med Sci. 2023;21(10):1071–84.
11. Adib-Hajbaghery M, Azizi-Fini E. Longitudinal study of cardiopulmonary resuscitation knowledge and skills among nurse interns of Kashan university of medical sciences. Iran J Med Educ. 2013;13(2):134–45.
12. Cheng A, Magid DJ, Auerbach M, Bhanji F, Bigham BL, Blewer AL, et al. Part 6: resuscitation education science: 2020 American heart association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. Circulation. 2020;142(16Suppl2):S551–79.
13. Khoshnoodifar M, Rafie S, Zeraati Nasrabadi M, Masoudi Alavi N. the effects of CPR training using two traditional and electronic training methods on the knowledge, skill, and satisfaction of nurses from in-service education of cardiopulmonary resuscitation. Qom Univ Med Sci J. 2019;13(9):34–43.
14. Nemati F, Tabatabaee A, Salehi Z, Mohammadnejad E. The effect of cardiopulmonary cerebral resuscitation (CPCR) on nurses' knowledge and performance: literature review. Iran J Cardiovasc Nurs. 2021;10(1):142–9.
15. Farsi Z, Yazdani M, Butler S, Nezamzadeh M, Mirlashari J. Comparative effectiveness of simulation versus serious game for training nursing students in cardiopulmonary resuscitation: a randomized control trial. Int J Comput Games Technol. 2021;2021:1–12.
16. Chandrasekaran S, Kumar S, Bhat SA, Shabbir PM, Chandrasekaran V. Awareness of basic life support among medical, dental, nursing students and Doctors. Indian J Anaesth. 2010;54(2):121.
17. Akhlaghdoust M, Safari S, Davoodi P, Soleimani S, Khorasani M, Raoufizadeh F et al. Awareness of Iranian medical sciences students towards basic life support; a cross-sectional study. Archives Acad Emerg Med. 2021;9(1).
18. Akbari Farmad S, Khoshnoodi Far M, Rezaee M, Farajpour A. The effect of simulation-based cardiopulmonary resuscitation training on knowledge and clinical skills of nurses in Baharloo hospital. Educational Dev Judishapur. 2021;12(2):511–20.
19. Ghaderi MS, Malekzadeh J, Mazloum S, Pourghaznein T. Comparison of real-time feedback and debriefing by video recording on basic life support skill in nursing students. BMC Med Educ. 2023;23(1):1–7.
20. Arabpur A, Farsi Z, Butler S, Habibi H. Comparative effectiveness of demonstration using hybrid simulation versus task-trainer for training nursing students in using pulse-oximeter and Suction: a randomized control trial. Nurse Educ Today. 2022;110:105204.
21. Amiri F, Haghighizadeh MH. The effect of personalized video feedback on the level of endotracheal intubation knowledge of bachelor of science students of anesthesiology. J Crit Care Nurs. 2022;15(3):0.
22. Mahoney P, Macfarlane S, Ajjawi R. A qualitative synthesis of video feedback in higher education. Teach High Educ. 2019;24(2):157–79.
23. Yığıt MF, Seferoğlu SS. Investigating the effect of video-based feedback on perceived feedback quality. Pamukkale Üniversitesi Eğitim Fakültesi Dergisi. 2021(51):92–122.
24. Yang X, Xie R-H, Chen S, Yu W, Liao Y, Krewski D, et al. Using video feedback through smartphone instant messaging in fundamental nursing skills teaching: an observational study. JMIR mHealth uHealth. 2019;7(9):e15386.
25. Lowenthal PR, Fiock HS, Shreaves DL, Belt ES. Investigating students' perceptions of screencasting style of video feedback in online courses. TechTrends. 2022;66(2):265–75.
26. Alkatout I, Dhanawat J, Ackermann J, Freytag D, Peters G, Maass N, et al. Video feedback and video modeling in teaching laparoscopic surgery: a visionary concept from Kiel. J Clin Med. 2021;10(1):163.
27. Yiğit MF, Seferoğlu SS. Effect of video feedback on students' feedback use in the online learning environment. Innovations Educ Teach Int. 2023;60(1):15–25.
28. van Vondel S, Steenbeek H, van Dijk M, van Geert P. The effects of video feedback coaching for teachers on scientific knowledge of primary students. Res Sci Educ. 2018;48:301–24.
29. McCutcheon K, O'Halloran P, Lohan M. Online learning versus blended learning of clinical supervisee skills with pre-registration nursing students: A randomized controlled trial. Int J Nurs Stud. 2018;82:30–9.
30. Farsi Z, Nasiri M, Sajadi SA, Khavasi M. Comparison of Iran's nursing education with developed and developing countries: a review on descriptive-comparative studies. Bmc Nurs. 2022;21(1):105.
31. Abdi A, Seyyed Mazhari M. The impact of basic life support teaching program using concept mapping method on meaningful learning in nursing students of AJA. Military Caring Sci J. 2017;3(4):233–41.
32. Sullivan GM, Feinn R. Using effect size—or why the P value is not enough. J Graduate Med Educ. 2012;4(3):279–82.
33. Demirtas A, Guvenc G, Aslan Ö, Unver V, Basak T, Kaya C. Effectiveness of simulation-based cardiopulmonary resuscitation training programs on fourth-year nursing students. Australasian Emerg Care. 2021;24(1):4–10.
34. Lin L, Ni S, Liu Y, Xue J, Ma B, Xiong D, et al. Effect of peer video recording feedback CPR training on students' practical CPR skills: a randomized controlled manikin study. BMC Med Educ. 2022;22(1):1–7.
35. Pérez-Segura JJ, Sánchez Ruiz R, González-Calero JA, Cózar-Gutiérrez R. The effect of personalized feedback on listening and reading skills in the learning of EFL. Comput Assist Lang Learn. 2022;35(3):469–91.
36. Aljamal Y, Saleem H, Prabhakar N, Abhishek C, Farley DR. Group video feedback is an effective and efficient tool for enhancing the skills of surgical interns. J Surg Res. 2020;251:248–53.

37. Kam BS, Yune SJ, Lee SY, Im SJ, Baek SY. Impact of video feedback system on medical students' perception of their clinical performance assessment. BMC Med Educ. 2019;19(1):1–7.
38. Wang S-A, Su C-P, Fan H-Y, Hou W-H, Chen Y-C. Effects of real-time feedback on cardiopulmonary resuscitation quality on outcomes in adult patients with cardiac arrest: a systematic review and meta-analysis. Resuscitation. 2020;155:82–90.
39. Wang Y, Ma S, Chen Z, Fan B, Hou S. Feedback devices for cardiopulmonary resuscitation: A narrative review. Appl Sci. 2023;13(18):10222.

Publisher's note