

Simulation-Based Basic Life Support Training: A Quasi-Experimental Study Comparing Peyton's Four-Step Approach with Traditional Teaching Among Undergraduate Medical Students

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ABSTRACT

Background: Basic Life Support (BLS) competence is an essential requirement for medical graduates; however, traditional teaching may provide limited opportunities for active learning and structured practice. Peyton's Four-Step Approach (PFSA) is a learner-centred method for teaching procedural skills, but evidence regarding its effectiveness in BLS skill acquisition and retention among undergraduate medical students in India remains limited.

Objectives: To evaluate the effectiveness of Peyton's Four-Step Approach compared with Traditional Teaching Method (TTM) in improving immediate BLS skill performance and one-month skill retention among undergraduate medical students. Secondary objectives were to assess learner satisfaction and confidence with the two teaching methods.

Methods: A quasi-experimental study was conducted among 100 third-year undergraduate medical students at GSL Medical College, Rajahmundry, Andhra Pradesh. Participants were non-randomly allocated into an experimental group receiving BLS training using Peyton's Four-Step Approach (n = 50) and a control group receiving Traditional Teaching Method (n = 50). BLS skills were assessed using a 15-item Objective Structured Clinical Examination (OSCE) checklist before training, immediately after training, and one month after the intervention. Student satisfaction and confidence were also assessed. Data were analysed using independent samples t-test and Chi-square test, with $p < 0.05$ considered statistically significant.

Results: Baseline OSCE scores were comparable between the PFSA and TTM groups (5.82 ± 1.34 vs. 5.68 ± 1.41 ; $p = 0.612$). The PFSA group demonstrated significantly higher immediate post-training OSCE scores than the TTM group (12.46 ± 1.18 vs. 10.84 ± 1.47 ; mean difference: 1.62; $p < 0.001$). At one-month follow-up, skill retention remained significantly higher in the PFSA group (11.72 ± 1.29 vs. 9.63 ± 1.58 ; mean difference: 2.09; $p < 0.001$). Student satisfaction was higher in the PFSA group than in the TTM group (90% vs. 16%; $\chi^2 = 54.96$; $p < 0.001$). Similarly, a greater proportion of students in the PFSA group reported confidence in performing BLS skills (88% vs. 10%; $\chi^2 = 30.43$; $p < 0.001$).

Conclusions: Peyton's Four-Step Approach was more effective than Traditional Teaching Method for improving immediate BLS skill performance and one-month skill retention among undergraduate medical students. The approach was also associated with greater student satisfaction and confidence. Incorporating structured, learner-centred approaches such as PFSA into undergraduate BLS training may enhance the acquisition and retention of essential resuscitation skills.

Keywords: Basic Life Support; Peyton's Four-Step Approach; Simulation-Based Education; Medical Education; Undergraduate Medical Students; OSCE

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INTRODUCTION

Out-of-hospital cardiac arrest remains a major global public health challenge, accounting for substantial mortality and disability.¹ Survival following cardiac arrest depends heavily on the prompt initiation of high-quality Basic Life Support

(BLS), including early recognition, effective chest compressions, timely ventilation, and rapid activation of emergency medical services.² The first few minutes following cardiac arrest are critical, as

immediate cardiopulmonary resuscitation (CPR) can double or even triple survival rates.³

Medical graduates are expected to be competent in Basic Life Support (BLS), as it is a fundamental life-saving skill. Recognizing its importance, the National Medical Commission (NMC) has incorporated BLS training into the Competency-Based Medical Education (CBME) curriculum through the Foundation Course and skills laboratories.⁴ Despite this initiative, studies from India and other countries have consistently reported that many undergraduate medical students lack adequate practical BLS competence.^{5,6} Common deficiencies include poor chest compression quality, incorrect ventilation techniques, failure to follow the recommended sequence of steps, and inadequate long-term retention of BLS skills.⁷

Traditional Teaching Method (TTM), demonstration-based follows a "see one, do one" approach, often encouraging passive learning with limited practice and feedback. As a result, students may develop suboptimal psychomotor skills and struggle to translate knowledge into effective procedural performance.^{8,9}

Peyton's Four-Step Approach (PFSA) is a learner-centred instructional model specifically designed for teaching procedural skills. Originally developed for surgical education, it consists of four sequential stages: Demonstration, Deconstruction, Comprehension, and Performance.¹⁰

International studies have shown that Peyton's Four-Step Approach improves immediate procedural skill acquisition compared with traditional teaching methods.^{11,12} However, evidence on long-term skill retention and its effectiveness among Indian undergraduate medical students remains limited. Moreover, studies comparing Peyton's four step approach with traditional teaching method using standardized competency-based assessment tools are scarce. This study addresses this gap by evaluating immediate BLS competency and one-month skill retention among third-year undergraduate medical students.

RESEARCH QUESTION

Does Peyton's Four-Step Approach improve Basic Life Support (BLS) practical skill performance immediately after training and at one-month follow-up compared with Traditional Teaching Method among undergraduate medical students?

RESEARCH HYPOTHESIS

Students trained using Peyton's Four-Step Approach will achieve significantly better Basic Life Support practical skills immediately after training and at one-month follow-up compared with students trained using Traditional Teaching Method.

Aim

To evaluate the effectiveness of Peyton's Four-Step Approach compared with Traditional teaching Method in teaching Basic Life Support skills among

undergraduate medical students at GSL Medical College.

Objectives

1. To compare the effectiveness of Peyton's Four-Step Approach and Traditional Teaching Method in improving Basic Life Support (BLS) skills immediately after training.
2. To determine the improvement and one-month retention of BLS skills between the two groups using OSCE scores.
3. To assess learner satisfaction and confidence with Peyton's Four-Step Approach for BLS training.

MATERIALS AND METHODS

Study Design: A Quasi-experimental study design

Study setting: The study was conducted in the Skills Laboratory (SMART Lab) at GSL Medical College & General Hospital, Rajahmundry, Andhra Pradesh.

Study Duration: The study was conducted over three months.

Study Population: The study population comprised of third-year undergraduate medical students enrolled at GSL Medical College during the study period.

Study Participants

Inclusion criteria: Undergraduate medical students of third year, those willing to participate, students providing written informed consent, and students available during all assessment sessions were included in the study

Exclusion criteria: Students previously certified in BLS or Advanced Cardiovascular Life Support (ACLS), those who have undergone structured simulation-based BLS training in the past, and students absent during intervention or follow-up assessments were excluded from the study

Sample size: The sample size was calculated by applying a standard formula

$[n = 16 \times 1/\text{effect size}^2]$.¹³ Keeping (α) at 0.05, the power (β) of the test at 0.8, medium effect size of 0.6, and considering dropout rate of 10 %, the sample size obtained was 97, which was rounded to the nearest 100; therefore, the final sample size obtained was 100.

Sampling technique: Convenience sampling technique was used to select 100 eligible medical students. The participants were non-randomly allocated into two groups of 50 students each: Experimental Group (EG) received BLS training using Peyton's four-step approach and a Control Group (CG) received BLS training using the Traditional teaching method.

Study tools: A semi-structured questionnaire was used to collect the data. The questionnaire was divided into three sections. Section A included socio-demographic details such as age, gender, and residential status of the study participants. Section B consisted of a 15-item predesigned, pre-validated,

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structured, closed-ended questionnaire containing OSCE check list. Section C included questions to know the status of satisfaction and confidence in skills after receiving the teaching method.

Data collection: A total of 100 undergraduate medical students were enrolled in the study. The experimental group received structured BLS training using Peyton's Four-Step Approach, whereas the control group received Traditional Teaching method. BLS skills were assessed by Objective Structured Clinical Examination (OSCE) before training, immediately after training, and one month after the intervention to evaluate both skill acquisition and retention. The OSCE assessment questionnaire included 15 questions to assess the BLS skills; each question is closed ended with options – Yes and No, each skill performed correctly was awarded one mark. The total score for OSCE is 15 marks.

Study Groups

Experimental

Group: The participants in the experimental group underwent training in BLS using Peyton's Four-Step Approach,¹¹ with an instructor feedback at the end. The training consisted of four sequential steps:

Step 1: Demonstration–The instructor performed the complete BLS procedure silently at normal speed without interruption.

Step 2: Deconstruction – The instructor repeated the procedure while explaining every individual step according to the latest American Heart Association (AHA) Basic Life Support algorithm.

Step 3: Comprehension– The Students instructed the faculty verbally while the instructor performed each step exactly as directed.

Step 4: Performance–Each student independently performed the complete BLS procedure under faculty supervision with immediate structured feedback. The entire session lasted approximately 90 minutes, including supervised hands-on practice.

Control Group: Students in the CG group received routine BLS teaching through Traditional Teaching Method. First, a didactic lecture was delivered by the instructor, followed by demonstration of complete BLS procedure; Next, students were allowed to practice individually with routine faculty supervision. The duration of training was identical to the experimental group to avoid differences attributable to training time.

Table 1: Teaching Method and Assessment Schedule

Time	EG (n=50)	CG (n=50)
T0- Before training	Baseline OSCE	Baseline OSCE

Teaching method (Intervention)	Peyton's Four Step Approach	Traditional Teaching Method
T1- Immediately After teaching/training	Immediate Post-test OSCE	Immediate Post-test OSCE
T2- 1 month after T1	1-month retention OSCE	1-month retention OSCE

Table 1 represents that each group includes 50 participants; For each group three assessments were conducted. All assessments were conducted using identical evaluation criteria for both groups.

Statistical analysis: Data analysis was performed using SPSS Statistics Version 26 software (trial version). Continuous variables were expressed as mean $\pm$ standard deviation and compared using the independent sample t-test. Categorical variables were analysed using the Chi-square test. A p-value of less than 0.05 was considered statistically significant.

Ethical approval: The study protocol was approved by the Institutional Ethics Committee of GSL Medical College. Prior to the initiation of the study, written informed consent was obtained from all study participants. Students were informed that participation was voluntary, and they can withdraw at any stage without academic consequences. Participant confidentiality was maintained through anonymization and secure storage of data. Each participant was assigned a unique identification number. After completion of the study, students in the control group also received Peyton's Four-Step BLS training to ensure equitable educational opportunity.

Operational definitions

- Basic Life Support (BLS):** BLS refers to the standardized sequence of immediate life-saving interventions performed for a person with cardiac arrest, including recognition of cardiac arrest, activation of emergency response, chest compressions, airway management, and appropriate ventilation, as taught according to the BLS protocol used in the study.²
- Peyton's approach:** Peyton's approach refers to four-step skills-teaching method used to teach BLS psychomotor skills, consisting of demonstration, deconstruction, comprehension, and performance. In this study, BLS will be taught to the experimental group using these four sequential steps according to a standardized teaching protocol.¹¹
- OSCE:** Objective Structured Clinical Examination (OSCE) refers to a structured

practical assessment in which students perform predefined BLS tasks at standardized stations and are evaluated using a predetermined checklist by trained assessors.¹⁴

RESULTS

A total of 100 undergraduate medical students were enrolled and divided equally into two groups: Experimental group (PFSA group; n = 50) and Control group (TTM group; n = 50). All participants completed the study and were included in the final data analysis.

Table 2: Socio-Demographic characteristics of the study participants

Socio-Demographic variables	n = 100	Percentage (%)
Age (in years)		
20-21	72	72 %
22-24	28	28%
Gender		
Male	32	32%
Female	68	68%
Residential status		
Hosteler	85	85%
Day scholar	15	15%

Table 2 represents that majority (72%) of the study participants were between 20-21 years. More than half (68%) of the sample were female students, and majority (85%) were hostellers.

Table 3: Comparison of Baseline, immediate Post-test, and 1-month Retention OSCE scores between the Experimental and Control groups

Assessment (OSCE)	EG (n=50)	CG (n=50)	Mean Difference	t-value	p-value
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Base line	5.82 ± 1.34	5.68 ± 1.41	0.14	0.51	0.612
Immediate post-test	12.46 ± 1.18	10.84 ± 1.47	1.62	6.16	<0.001
1-month retention	11.72 ± 1.29	9.63 ± 1.58	2.09	7.40	<0.001

Table 3 shows that there was no statistically significant difference in the OSCE scores between EG and CG, prior to the intervention. whereas statistically significant difference was observed between the groups in immediate post-test and 1-month retention OSCE scores. A significantly higher immediate BLS skill performance and retention was observed in the EG (PFSA group). p-value < 0.05 was considered statistically significant.

Table 4: Association of students' satisfaction with the teaching method

Status of satisfaction	EG (PFSA) (n = 50) n (%)	CG (TTM) (n = 50) n (%)	Chi-square statistic	p-value
Satisfied	45 (90%)	8 (16%)	54.96	< 0.001
Dissatisfied	5 (10%)	42 (84%)		
Total	50 (100%)	50 (100%)		

Table 4 depicts that there is a statistically significant association between the teaching method and student satisfaction ($\chi^2 = 54.96$, df = 1, p < 0.001). Therefore, the null hypothesis of no association is rejected. Students in the EG (PFSA) group showed substantially higher satisfaction (90%) compared with students in the CG (TTM) group (16%). p-value < 0.05 was considered statistically significant.

Table 5: Association between students' confidence and the teaching method

Status of Confidence	EG (PFSA) (n = 50) n (%)	CG (TTM) (n = 50) n (%)	Chi-square statistic	p-value
Confident	44 (88%)	5 (10%)	30.43	< 0.001
Not confident	6 (12%)	45 (90%)		
Total	50 (100%)	50 (100%)		

Table 5 demonstrates statistically significant association between students' confidence and the teaching method ($\chi^2 = 30.43$, $df = 1$, $p < 0.001$). Therefore, the null hypothesis of no association is rejected. Students in the EG (PFSA) group demonstrated significantly higher confidence (88%) compared with students in the CG (TTM) group (10%). p -value < 0.05 was considered statistically significant

DISCUSSION

The present study was conducted to compare the effectiveness of Peyton's Four-Step Approach (PFSA) and the Traditional Teaching Method (TTM) in improving Basic Life Support (BLS) skills among undergraduate medical students. The study also examined the retention of BLS skills after one month and assessed students' satisfaction and confidence with the two teaching approaches.

Comparison of BLS Skills Before and After Training

The present study found no statistically significant difference in baseline OSCE scores between the experimental and control groups, indicating comparable initial BLS skills. Thus, the significant post-intervention differences can reasonably be attributed to the teaching method rather than baseline differences in student performance.

After training, the PFSA group demonstrated significantly higher immediate post-test OSCE scores than the Traditional Teaching group, indicating that PFSA was more effective in improving practical BLS skills immediately after training. One possible reason for this improved performance is the structured and progressive nature of Peyton's Four-Step Approach. The method allows

students to first observe the complete skill, understand each step through explanation and demonstration, actively participate by verbalizing the procedure, and finally perform the skill independently.

The gradual transition from observation to independent performance may help students understand not only 'what' to do but also 'how' and 'why' each step should be performed. The present study results are consistent with the findings of Giacomino et al., whose meta-analysis demonstrated that Peyton's approach significantly enhances procedural skill acquisition across healthcare learners.¹¹ Similarly, Krautter et al. reported superior OSCE performance among students trained using structured stepwise methods compared to traditional instruction.¹⁵

An evidence from resuscitation training also supports the findings of the present study. A recent randomized controlled study by Cenaj et al. comparing Peyton's Four-Step Approach with traditional two-step instruction for resuscitation skills found that Peyton's approach enhanced the acquisition of procedural CPR skills and improved adherence to the resuscitation algorithm.¹⁶

In contrast, traditional teaching methods often rely mainly on demonstration followed by student practice. Although this method can provide students with exposure to the skill, it may not always ensure active engagement and deep understanding of every step in the procedure.¹⁷ BLS is a practical skill that requires students to perform a sequence of actions accurately and confidently.³ Therefore, a teaching method that encourages active participation and repeated practice may be more beneficial for skill acquisition.

The findings of the present study support the first objective, which was to compare the effectiveness of Peyton's Four-Step Approach and the Traditional Teaching Method in improving BLS skills immediately after training. The significantly higher immediate post-test OSCE scores among students in the PFSA group demonstrate that Peyton's approach was more effective than the Traditional Teaching Method in improving immediate BLS skill performance.

Improvement and One-Month Retention of BLS Skills

An important finding of the present study was that the experimental group also demonstrated significantly better BLS skill retention after one month compared with the control group. This suggests that the benefits of Peyton's Four-Step Approach were not limited to immediate learning but continued beyond the training session.

Skill retention is particularly important in BLS training because students may not perform these skills regularly in clinical practice.¹⁸ If a skill is learned only through passive observation or brief practice, there is a greater possibility that the learner

may forget important steps over time.¹¹ The structured repetition involved in Peyton's Four-Step Approach may help strengthen memory and improve long-term retention.¹⁵

The significantly higher one-month retention OSCE scores among the PFSA group indicate that this active learning process may have helped students retain BLS skills more effectively than those trained using the Traditional Teaching Method. These findings are important because successful BLS training should not only improve performance immediately after teaching but should also help students remember and perform the skill correctly when needed in the future.

The results therefore support the second objective of the study, which was to determine the improvement and one-month retention of BLS skills between the two groups. Students trained using Peyton's Four-Step Approach showed better immediate improvement as well as better retention of BLS skills after one month. This finding is similar to a previous study which reported that the retention of the skills was 90% after 1 month.¹⁹

Student Satisfaction with the Teaching Method

The present study also found a statistically significant association between the teaching method and student satisfaction. Students in the experimental group reported substantially higher satisfaction, with 90% of students in the PFSA group expressing satisfaction compared with only 16% in the Traditional Teaching Method group. The association was statistically significant ($\chi^2 = 54.96$, $df = 1$, $p < 0.001$). This finding is consistent with Saini et al. who reported significantly higher satisfaction among medical students who were taught using PFSA compared with conventional bedside teaching ($p < 0.001$).²⁰ This finding clearly suggests that students found Peyton's Four-Step Approach to be a more satisfactory method of learning BLS skills. The high level of satisfaction among students in the experimental group may be related to the interactive and learner-centred nature of the method. Rather than simply watching an instructor and then attempting the procedure, students were actively involved throughout the learning process.

Students may also have appreciated the opportunity to understand the procedure step by step before performing it independently. Learning a new clinical skill can sometimes be stressful, particularly when students are unsure about the correct sequence of actions.²¹ Peyton's approach provides a clear structure and allows learners to gradually build their skills. This may make the learning experience feel more manageable and less overwhelming.¹¹

The much lower satisfaction reported in the Traditional Teaching Method group may suggest that demonstration and routine practice alone may not meet all learners' needs. While traditional teaching remains a commonly used approach for

clinical skills training, students may benefit more when they are actively engaged and given opportunities to think through the procedure in a structured manner.

Therefore, the findings suggest that Peyton's Four-Step Approach not only improves practical performance but also creates a more positive learning experience for students. This is particularly relevant in medical education, where student engagement and satisfaction can influence motivation and willingness to participate in future learning activities.

Student Confidence in Performing BLS Skills

Another important finding of the present study was the significant association between the teaching method and students' confidence. A significantly higher proportion of students in the PFSA group reported confidence in performing BLS skills (88%) compared with only 10% of students in the TTM group. This difference was statistically significant ($\chi^2 = 30.43$, $df = 1$, $p < 0.001$). These findings are in line with those reported in previous studies.^{11, 16}

The higher confidence levels observed in the PFSA group may be explained by the repeated and active involvement of students during training. Peyton's Four-Step Approach allows learners to move gradually from observing the skill to explaining it and finally performing it independently. This step-by-step progression may help students feel more prepared and capable by the end of the training session.

The opportunity to verbalize and direct the procedure before independently performing it may also help students identify and correct gaps in their understanding. As a result, students may develop a stronger sense of mastery over the skill. This feeling of mastery may explain why a large proportion of students in the experimental group reported greater confidence.

In comparison, the very low confidence reported among students in the Traditional Teaching Method group may indicate that observing and practicing a skill without the same level of structured guidance and active recall may not be sufficient to build confidence. Students may still have doubts about the sequence or correctness of their performance.

The findings related to confidence are closely connected with the improved OSCE performance observed in the PFSA group. Students who performed better and retained the skills more effectively were also more likely to feel confident about performing BLS. Although confidence does not always guarantee correct performance, developing both competence and confidence is important for preparing medical students to respond effectively in emergency situations.

Limitations of the study

This study has certain limitations. The quasi-experimental design with non-random allocation may introduce selection bias. The study was

conducted at a single institution using convenience sampling, which may limit the generalizability of the findings. Additionally, BLS skill retention was assessed only up to one month; therefore, long-term retention could not be evaluated.

Conclusion

In conclusion, this study shows that Peyton's Four-Step Approach is more effective than the Traditional Teaching Method for teaching Basic Life Support skills to undergraduate medical students. Students trained using Peyton's approach performed better immediately and retained their skills better after one month. They also reported higher satisfaction and confidence. The structured, interactive, and learner-centred approach promotes deeper learning through observation, understanding, verbalization, and practice. Therefore, Peyton's Four-Step Approach is an effective method for BLS training and may also be useful for teaching other clinical and psychomotor skills.

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