

Effectiveness of Simulation-Based Training in Enhancing BLS Knowledge and Skill Competency among Physiotherapy Students: An OSCE-Based Assessment

Dr. Javed Ashraf Syed¹, Kavita Chandrakar¹

¹National Head-Simulation & Training, Vydehi Advanced Simulation Academy, Bangalore-560066

²Associate Centre Head, Vydehi Advanced Simulation Academy, Bangalore-560066

Abstract: Background: Basic Life Support (BLS) is a critical skill for healthcare professionals, but there are still gaps in both knowledge and hands-on competency among physiotherapy students. Pairing objective structured clinical examination (OSCE) with simulation-based training provides a potential technique for skill development and evaluation. Objective: To evaluate the effectiveness of simulation-based training in enhancing knowledge and skill competency in BLS among Bachelor of Physiotherapy (BPT) students, using OSCE as an objective assessment tool. Methods: A quantitative, pre-experimental one-group pre-test post-test design was employed. A total of 93 BPT students were selected via convenient sampling at Vydehi Advanced Simulation Academy, Bangalore. Participants completed a structured knowledge questionnaire before and after simulation-based training. Post-training, BLS skills were assessed using an OSCE checklist encompassing components such as scene safety, compressions, ventilations, and AED usage. Paired t-test was used for statistical analysis. Results: Post-training, there was a significant increase in knowledge scores (pre-test mean = 6.66, post-test mean = 8.23; $t = 5.29$, $p < 0.01$). Skill assessment showed excellent competency in compressions (100%) and AED usage (100%), while 96% performed well in ventilations and 87% in scene safety. The data demonstrated a marked improvement in both cognitive understanding and hands-on skill performance after simulation-based training. Conclusion: Simulation-based training significantly improves BLS knowledge and skill competency among physiotherapy students. OSCE proved to be an effective and objective method for post-training skill evaluation. Integration of simulation and OSCE into physiotherapy curricula is recommended to foster clinical readiness and confidence in emergency response scenarios.

Keywords: Simulation-based training, BLS, OSCE, Physiotherapy, Clinical competency, Skill assessment, VASA

1. Introduction

Basic Life Support (BLS) is a critical set of life-saving interventions that form the foundation of emergency cardiovascular care. Prompt recognition of cardiac arrest, high-quality chest compressions, and early defibrillation significantly improve survival rates¹. For healthcare professionals, especially physiotherapists who are often first responders in rehabilitation and acute care settings, competence in BLS is essential.

Traditional teaching methods may fall short in equipping students with the hands-on proficiency and decision-making skills required in real-life emergencies². Simulation-based training (SBT) has emerged as an innovative educational strategy that bridges this gap by providing a realistic, immersive, and safe environment for learning³. It allows repeated practice, immediate feedback, and performance refinement, which are crucial for mastering life-saving techniques⁴.

The Objective Structured Clinical Examination (OSCE) serves as a reliable and standardized tool to assess clinical competence, including both cognitive and psychomotor skills⁵. When used in conjunction with simulation-based training, it can effectively evaluate the impact of the training on learners' performance.

This study aims to assess the effectiveness of simulation-based training in enhancing BLS knowledge and skill

competency among physiotherapy students, using OSCE as the primary mode of evaluation. The findings may contribute to improved educational approaches and better preparedness of physiotherapy graduates to respond confidently and competently during life-threatening situations.

Objectives:

- 1) To assess the pre-test level of knowledge of participants regarding Basic Life Support (BLS) before simulation-based training.
- 2) To assess the post-test level of knowledge of participants regarding Basic Life Support (BLS) after simulation-based training.
- 3) To evaluate the effectiveness of simulation-based training by comparing pre-test & post-test knowledge scores.
- 4) To assess BLS skill competency post-training using OSCE as an objective method of assessment.

2. Materials & Methods

The research approach adopted was a *Quantitative Evaluatory Approach*. A *pre-experimental, one-group pre-test post-test design* was used to assess the effectiveness of simulation-based teaching in enhancing knowledge and skill competency in Basic Life Support (BLS) among physiotherapy students, using Objective Structured Clinical Examination (OSCE) as the method of skill assessment. The study involved administering a structured knowledge questionnaire (pre-test and post-test) and evaluating BLS

post skill performance using an OSCE-based skill checklist. The simulation-based teaching session was conducted after the pre-test, and both knowledge and skill performance were assessed again post-intervention. The researcher clearly explained the purpose of the study to the participants and assured them of the confidentiality and anonymity of the information collected. The study was conducted in a controlled academic simulation setting at Vydehi Advanced Simulation Academy, Bangalore.

Sample and Sampling Technique

The study sample consisted of 93 physiotherapy students. A *convenient sampling technique* was employed to select participants who were available during the designated academic sessions.

Inclusion Criteria:

- Physiotherapy students available during scheduled academic simulation sessions.
- Students who gave informed consent to participate.

Exclusion Criteria:

- Students absent during the training sessions.
- Students who did not consent to participate.

Tools for Data Collection:

The tool consisted of three sections:

- **Section A** – Structured questionnaire to collect socio-demographic data of participants.
- **Section B** – Structured knowledge questionnaire (pre-test and post-test) to assess knowledge regarding BLS.
- **Section C** – OSCE-based skill audit checklist to objectively evaluate BLS performance competency post-training.

3. Results

Statistical Analysis:

Descriptive statistics and inferential statistics were applied for the data analysis. The collected data were analyzed by Paired “t” test which was used to know the difference in mean knowledge score.

Table 1: Distribution of demographic variables of participants according to frequency & percentage

S. No	Socio-demographic data	Frequency	Percentage
1	Age (in years)		
	18-19	15	16
	19-20	36	39
	20-21	25	27
	21-22	9	10
	22-23	0	0
	23-24	8	9
2	Gender		
	Female	65	70
	Male	28	30
3	BPT Course		
	BPT 2nd yr	68	73
	BPT 3rd yr	24	26
	BPT 4th yr	1	1
4	Previous Knowledge		
	Yes	52	56
	No	41	44

The socio-demographic profile of the participants revealed that the majority were within the age group of 19–20 years (39%), followed by 20–21 years (27%) and 18–19 years (16%). A smaller proportion of participants were aged 21–22 years (10%) and 23–24 years (9%), with no participants in the 22–23 years category. In terms of gender distribution, the study group was predominantly female, comprising 70% of the participants, while males accounted for 30%.

With respect to academic standing, most of the students were in their 2nd year of the Bachelor of Physiotherapy (BPT) program (73%), followed by 26% in the 3rd year, and only 1% in the 4th year. When assessed for previous knowledge related to Basic Life Support (BLS), 56% of the participants reported having prior knowledge, whereas 44% had no previous exposure to BLS content.

Table 2: Frequency and percentage distribution of knowledge score before intervention and after intervention among participants (n = 93)

Level of knowledge	Pre-test		Post-test	
	Frequency	Percentage	Frequency	Percentage
Inadequate knowledge (<50%)	18	19	3	3
Moderately Adequate knowledge (51-75%)	40	43	8	9
Adequate knowledge (>76%)	35	38	82	88

The table presents a comparative analysis of the participants' knowledge levels regarding Basic Life Support (BLS) before and after simulation-based training. Prior to the intervention, only 38% of the students demonstrated adequate knowledge (>76%), while 43% had moderately adequate knowledge (51–75%) and 19% showed inadequate knowledge (<50%). Following the training, there was a substantial improvement, with 88% of participants achieving adequate knowledge. The proportion of students with moderately adequate knowledge dropped to 9%, and those with inadequate knowledge reduced significantly to just 3%.

This substantial shift indicates that simulation-based training was highly effective in enhancing the cognitive understanding of BLS among participants, reinforcing its value as a teaching strategy in clinical education.

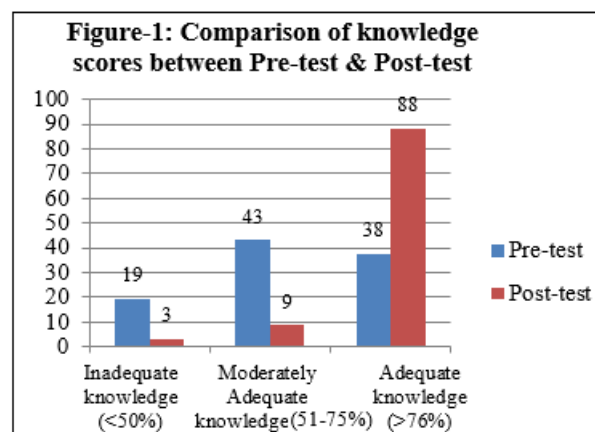


Figure 1

Figure 1: Illustrates the comparison of knowledge levels regarding Basic Life Support (BLS) among participants before and after **simulation-based training**. The graph clearly shows a **substantial improvement in knowledge post-intervention**.

Table 3: Frequency and percentage distribution of BLS Skill Performance Levels among Physiotherapy Students in OSCE Stations (n = 93)

Level of Skill-BLS Approach in OSCE Station	Frequency	Percentage
Scene Safety		
Poor performance ($\leq 50\%$)	12	13
Average performance (51-75%)	0	0
Good performance ($\geq 76\%$)	81	87
Compressions		
Poor performance ($\leq 50\%$)	0	0
Average performance (51-75%)	0	0
Good performance ($\geq 76\%$)	93	100
Ventilations		
Poor performance ($\leq 50\%$)	0	0
Average performance (51-75%)	0	0

Good performance ($\geq 76\%$)	89	96
AED		
Poor performance ($\leq 50\%$)	0	0
Average performance (51-75%)	0	0
Good performance ($\geq 76\%$)	93	100

The data highlights the effectiveness of **simulation-based training** in enhancing BLS skill competency, as assessed through an OSCE checklist. A majority of participants (87%) performed well in **Scene Safety**, though 13% showed poor performance, indicating room for improvement in this area.

Compressions and **AED usage** showed excellent outcomes, with **100% of participants** demonstrating good performance, reflecting strong skill acquisition. In **Ventilations**, 96% achieved good performance, with minor scope for enhancement. Overall, the findings affirm that simulation-based teaching significantly improves BLS skills, though focused reinforcement is recommended for Scene Safety and Ventilations.

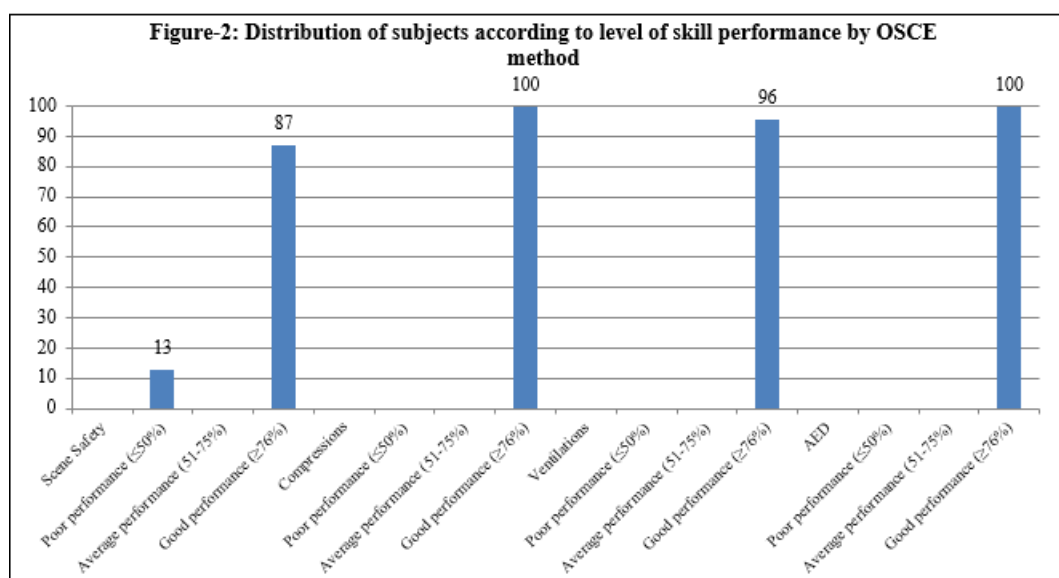


Figure: 2-Demonstrate that the majority of participants achieved **good performance ($\geq 76\%$)** across all BLS components following simulation-based training

Specifically, **100%** showed competency in **Compressions** and **AED use**, and **96%** in **Ventilations**. However, in **Scene Safety**, while **87%** performed well, **13%** showed poor performance, indicating a need for focused improvement in this initial BLS step. These results affirm the **effectiveness of simulation-based training** in enhancing practical BLS skills, with minor gaps noted in early assessment actions.

Table 4

Group (n=93)	Mean	SD	Paired 't' test		df	Inference
			Cal value	Tab value		
Pre-test	6.66	2.52	5.29*	1.66	92	S** p < 0.01
Post-test	8.23	1.34				

Table: 4-The table presents a statistical comparison of pre-test and post-test knowledge scores using a paired t-test to evaluate the effectiveness of simulation-based training on BLS. The mean pre-test score was 6.66 with standard deviation of 2.52, while the post-test mean increased to 8.23

with a reduced standard deviation of 1.34, indicating a notable improvement in knowledge following the intervention. The calculated t-value was 5.29, which is significantly higher than the tabulated t-value of 1.66 at 92 degrees of freedom, with $p < 0.01$, denoted as statistically highly significant (S).

This confirms that the simulation-based training was effective in enhancing the knowledge of participants regarding BLS.

4. Discussion

The Objective Structured Clinical Examination (OSCE) was used in this study to assess the efficacy of simulation-based training in improving physiotherapy students' knowledge and skill competence in Basic Life Support (BLS). The findings showed a statistically significant improvement in knowledge scores after the training, as well as a high level of

proficiency in fundamental BLS skills. The mean post-test knowledge score ($M = 8.23$, $SD = 1.34$) was considerably greater than the pre-test score ($M = 6.66$, $SD = 2.52$), with a paired t -value of 5.29 ($p < 0.01$). These findings are consistent with previous studies such as that of Chandrasekaran et al., who reported a significant increase in BLS knowledge among medical and paramedical students, where the mean score improved from 3.9 ± 1.0 to 9.6 ± 0.8 after training ($p < 0.001$) showed notable improvement in knowledge following structured BLS training among medical and paramedical students.⁶ Similarly, Sharma and Sharma the mean knowledge score increases from 6.2 to 8.8 post-simulation ($p < 0.001$) among nursing students, demonstrating strong cognitive gains.⁷

Skill performance outcomes were strong, with 100% of participants demonstrating good performance in chest compressions and AED use, 96% in ventilations, and 87% in scene safety. This aligns with findings from Choi et al., who noted a marked improvement in CPR performance, with mean compression scores increasing from 5.6 to 9.2 out of 10 and ventilation skills improving significantly post-simulation training ($p < 0.001$).⁸ The immersive nature of simulation promotes muscle memory, quick reflexes, and confidence under pressure.⁹

However, the 13% poor performance in scene safety underscores the need to reinforce cognitive readiness, particularly in initial situational awareness. Wayne et al. also found that learners tend to bypass scene safety in high-stress scenarios, despite its critical importance.¹⁰ This suggests a need for repeated exposure to the concerned component in simulation modules.

OSCE served as an effective and structured method for evaluating skill performance in this study. Its use enabled standardized assessment of each component in the BLS sequence. Harden and Gleeson introduced the OSCE as an objective way to assess clinical competence, and subsequent research supports its utility for evaluating time-sensitive and procedural skills like CPR and AED use.¹¹ Hashim et al. evaluated OSCE's effectiveness in BLS assessment and reported a post-test OSCE score improvement from 11.5 ± 3.0 to 17.2 ± 2.8 out of 20 ($p < 0.001$), reinforcing our findings.¹²

Training physiotherapy students in BLS through simulation is often underutilized in allied health education. This study adds to the growing evidence that simulation-based emergency training equips non-medical professionals to respond competently. Furthermore, Kim et al. conducted a quasi-experimental study among paramedical students and observed a statistically significant gain in BLS knowledge (mean increased from 12.34 to 16.78, $p < 0.001$) and confidence scores after simulation-based training.¹³ In conclusion, the findings affirm that simulation-based training, combined with OSCE evaluation, is an effective approach for enhancing both knowledge and practical skills in BLS. While most components showed excellent outcomes, focused reinforcement is advised in areas like scene safety. Future research should examine long-term retention and clinical application in real-world emergencies.

5. Conclusion

The present study demonstrated that simulation-based training is highly effective in enhancing both the knowledge and skill competency of physiotherapy students in Basic Life Support (BLS). A statistically significant improvement was observed in post-test knowledge scores, and the majority of participants achieved high performance in key BLS components such as chest compressions, ventilations, and AED usage. The use of Objective Structured Clinical Examination (OSCE) as a method of assessment provided a reliable and objective measure of participants' practical skills. These findings support the incorporation of simulation-based learning and structured assessments like OSCE into physiotherapy and allied health education curricula. While results were overwhelmingly positive, the study also identified scene safety as an area requiring additional instructional emphasis. Overall, simulation emerges as a powerful educational strategy for preparing healthcare students to respond effectively in emergency situations.

Conflicts of Interest: The author has declared that they have no conflicts of interest.

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