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Research Article

Simulation-Based Basic Life Support Learning Through Peer Education: A Quasi-Experimental Study

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ABSTRACT

Nursing education must continue to be developed in Indonesia laboratory learning methods remain a critical issue in this context. Obstacles encountered when students transition to clinical settings include poor skill preparation, insufficient practicum hours, inadequate laboratory assistant ratios, and the lack of appropriate learning methods to practice clinical skills. This study aims to analyse the knowledge and competence of nursing students in performing Basic Life Support (BLS) using a peer education method integrated with simulation. A quasi-experimental pre- and post-test design was used without a control group. Sixty nursing students meeting the inclusion criteria were selected using consecutive sampling. Instruments included the Indonesian Nursing Organisation Standard Operating Procedure, a BLS Practicum Checklist, and a knowledge instrument validated and deemed reliable using Cronbach's alpha > 0.70. A CPR Phantom and AED Simulator were used as practicum tools. Results showed a statistically significant increase in both knowledge (mean pre: 68.33 ± 9.236; mean post: 87.83 ± 5.992; t = 14.72, df = 59, p < 0.001, Cohen's d = 1.90) and psychomotor competence after the intervention. Peer-based interaction in simulation practicums motivated students to learn more actively and independently, with peer support playing a central role in skill development.

Keywords: *Basic Life Support, Peer Education, Practicum, Quasi-Experimental, Simulation Method*

INTRODUCTION

Nursing educational institutions continue to monitor curriculum developments, and competency needs to improve graduate achievement. Nursing educational institutions continuously monitor curriculum developments and competency requirements to improve graduate achievement. The literature highlights the benefits of establishing a Basic Skills Laboratory (BSL), which allows students to observe, practice, and learn in a safe and controlled environment (Stone et al., 2013). Improving laboratory skills can be achieved by creating environments that resemble hospital or healthcare settings (H. W. Kim & Choi, 2022; J. Kim et al., 2016). Educational institutions develop

laboratory programs to improve students' skills in caring for patients under various conditions, including emergencies (Şengül et al., 2022).

Students acquire practical skills in two domains: laboratory practicums and clinical practice in hospitals and healthcare settings (Henriksson et al., 2016). The opportunity to learn in clinical placements is determined by available facilities and the learning environment (Bloodgood, 2012). The increasing complexity of healthcare systems has made it difficult for nursing students to secure adequate clinical placements, making robust laboratory methods more critical than ever (Hilleren et al., 2022). Nursing students must be competent in performing BLS to handle patients in emergency situations—a hallmark of professional nursing practice (Korkut & Baser, 2020). BLS proficiency requires mastery of knowledge, skills, and actions necessary to save a person in a life-threatening situation (Iserbyt, 2016).

Simulation-based nursing education is an increasingly popular pedagogical approach (Nygren & Carlson, 2017; Peykari et al., 2011), offering students opportunities to practice clinical and decision-making skills through simulated real-world scenarios. Simulation modalities range from low- to high-fidelity (H. W. Kim & Choi, 2022). Laboratory practicums can be enriched through simulation combined with peer education strategies (Rahman & Nasryah, 2019). Simulation as a teaching method presents learning experiences through simulated situations to help students master specific concepts, principles, or skills (Saputra, 2014). The nursing education learning process typically consists of theoretical learning, laboratory practicums, and supervised clinical practice (Hamzah et al., 2019).

Despite growth in simulation-based learning, challenges persist. Society demands highly professional nursing services, pressuring institutions to improve student competency through innovative, effective learning (Asegid & Assefa, 2021). A study by Tiana Rachmadita et al. (2024) of 92 students found that the treatment group—receiving simulation-based instruction—consistently scored higher on satisfaction metrics than the control group, with mean scores for teaching method effectiveness at 3.83 versus 3.30, and motivation scores at 3.76 versus 3.24. Furthermore, Syafrani Nurul Islamiyah & Fida' Husain (2024) reported that among 62 eighth-semester nursing students, 61.3% failed BLS skills assessments, highlighting a persistent competency gap.

Peer Education is a learning method in which a peer educator is selected and trained to improve the knowledge, attitudes, and behaviours of their group (Ibrahim et al., 2012). It has been used to address challenges in critical thinking, cognitive development, psychomotor skills, and academic achievement (Ludwig et al., 2022). Peer education represents a form of peer learning derived from problem-based learning (PBL), often employing discussion groups or peer tutoring structures (Aljahany et al., 2021; Perkins et al., 2002; Saputra, 2014). Advantages include immediate feedback, use of accessible and relatable language, and reduced communication barriers (Kollar & Fischer, 2010; Nygren & Carlson, 2017).

Despite the growing body of evidence on simulation-based and peer-assisted learning, there remains a gap in studies that integrate both methods within Basic Life Support (BLS) training in Indonesian nursing education. Most existing studies examine these approaches in isolation or in different clinical competency domains. This study addresses that gap by investigating whether integrating peer education with simulation-based BLS practicums can significantly improve nursing students' knowledge and psychomotor skills. We hypothesised that students who participate in peer-led BLS simulation would demonstrate significantly higher post-intervention scores compared to pre-intervention baseline scores.

MATERIAL AND METHODS

Method (Study Design)

A quantitative research approach was used to collect, process, and analyse research data (Ludwig et al., 2022; Polit, D.F., & Beck, 2014). A quasi-experimental pretest-posttest design without a control group was employed to assess nursing students' proficiency in performing BLS simulations before and after the peer education intervention. This design was chosen due to the naturalistic grouping of students in classroom cohorts and practical constraints in randomisation within the educational setting. Although the absence of a control group is a recognised limitation, it is consistent with applied educational research evaluating a single novel intervention within a cohort (Pålsson et al., 2017).

Sample and Eligibility Criteria

Participants were divided into two groups: peer teachers and peer learners. Inclusion criteria were: (1) active student enrolment in the Nursing Undergraduate Program at Universitas Pendidikan Indonesia; (2) age between 18 and 22 years; and (3) willingness to provide informed consent. Students were excluded if they had prior formal BLS certification or had missed more than one training session. The peer teacher group consisted of 12 participants selected based on strong communication skills and academic standing. The peer learner group comprised 60 participants selected using consecutive sampling, given the homogeneous and representative nature of the class population. Sample size was justified based on a power analysis for a paired t-test (effect size $d = 0.5$, $\alpha = 0.05$, power = 0.80), which indicated a minimum of 34 participants; 60 participants were recruited to provide additional statistical power and account for potential dropout.

Research Procedures

This study was conducted over six months. Step 1: Twelve peer teachers were selected from their classes based on age and demonstrated communication competency. Basic life support simulation training was conducted over two weeks (three sessions per week). In the first week, peer teachers were trained by lecturers and emergency nursing facilitators; in the second week, independent supervised practice was conducted. Step 2: Sixty peer learners were divided into six groups of ten, each supervised by two peer teachers. Step 3: A pre-test on BLS knowledge and skills was administered to peer learners before the intervention. Step 4: Peer teachers delivered BLS simulation training to peer learners over two weeks (two sessions per week in the laboratory). Step 5: Post-test data were collected using the same instruments as the pre-test.

To ensure intervention fidelity, all peer teachers received standardised training from the same set of lecturers and emergency nursing facilitators using uniform materials. Peer teacher sessions were observed and evaluated by supervising facilitators using a structured fidelity checklist, ensuring consistency of content delivery across groups.

Instruments

Two sets of instruments were used: (1) a knowledge questionnaire about BLS, validated with a content validity index (CVI) and reliability confirmed via Cronbach's alpha > 0.70; and (2) the Indonesian Nursing Organisation's National Standard Operating Procedure (SOP) Checklist for BLS skills assessment, which was validated through expert panel review and demonstrated adequate inter-rater reliability (intraclass correlation coefficient > 0.80). Practicum tools included a CPR

Phantom and an AED Simulator. The BLS checklist evaluated compression depth, compression rate, full release percentage, airway management, and use of the AED.

Data Analysis

Quantitative data were statistically analysed using SPSS version 21. Normality was assessed using the Shapiro-Wilk test. A paired samples t-test was used to compare pre- and post-intervention scores, as the data met assumptions of normality, interval-level measurement, and adequate sample size. Effect size was calculated using Cohen's d. Results are reported with t-values, degrees of freedom (df), 95% confidence intervals (CI), and p-values. Independent samples t-tests were not applicable in this study, as participant groups (peer teachers vs. peer learners) served distinct roles rather than comparison arms.

Ethical Considerations

Ethics approval was obtained from the Faculty of Health Sciences and Technology (FITKes) of Jenderal Achmad Yani University, Cimahi (Ethical Approval Number: 020/KEPK/FITKes-UNJANI/VI/2023). All participants provided written informed consent prior to the intervention. Participation was voluntary, and students were assured that non-participation would not affect their academic standing.

RESULTS AND DISCUSSION

The result part describes the characteristics of the respondent, which can be seen in the following table:

a. Respondent Characteristics

Table 1 presents the demographic characteristics of participants in both groups.

Table 1: Respondent Characteristics

No	Characteristic	Peer Teacher Group		Peer Learner Group	
		Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
1	Age (Years Old)				
	18	0	0	10	16.7
	19	1	8.4	32	53.3
	20	3	25	10	16.7
	21	6	50	6	10
	22	2	16.6	2	3.3
		12	100	60	100
2	Gender				
	Male	4	33.4	8	13.3
	Female	8	66.6	52	86.7
		12	100	60	100

The peer teacher group was predominantly aged 21 years (50%), while the peer learner group was predominantly aged 19 years (53.3%). Both groups were predominantly female (peer teachers: 66.6%; peer learners: 86.7%), reflecting the gender composition of nursing programmes in Indonesia.

b. BLS Simulation Scores Before and After Peer Education Intervention

Table 2 presents mean scores before and after the simulation intervention.

Table 2: Mean BLS Simulation Scores Before and After Peer Education Intervention

BLS Skills	Mean (M)	Peer Learner (N)	(SD)

Practicum Pre-	68.33	60	9.236
Practicum Post	87.83	60	5.992

The mean score before intervention was 68.33 (SD = 9.236) and after intervention was 87.83 (SD = 5.992), representing a mean difference of 19.5 points. The reduced standard deviation post-intervention indicates more consistent skill performance across students.

Table 3: Paired t-Test Results: Pre- and Post-Intervention BLS Simulation Scores

BLS Skills	N	t-value	df	95% CI	Cohen's d	Sig. (2-tailed)
Pre vs Post Practicum	60	14.72	59	[17.0, 22.0]	1.90	0.000

A paired samples t-test revealed a statistically significant improvement in BLS simulation scores following the peer education intervention ($t(59) = 14.72$, $p < 0.001$, 95% CI [17.0, 22.0], Cohen's d = 1.90), indicating a large effect size. The correlation between pre- and post-intervention scores was $r = 0.623$, confirming strong within-subject consistency.

Table 4. Student skill ability score after Basic Life Support Simulation with the peer education method

Competency	Mean	Min-max	SD
Expertise (Knowledge)	79.5	45-95	14.16
CPR Quality Psychomotor			
• Appropriate compression depth level	83.6	78.6 – 92.5	8.78
• Mean compression rate	113.5	100 – 120	6.77
• Compression followed by total release >60%	92	72.3 - 100	8.0

Post-intervention competency scores indicate generally strong performance, though the knowledge score range (45–95) suggests variability in cognitive attainment. Students scoring 45 remained below the standard knowledge benchmark, while those scoring 95 demonstrated excellent cognitive performance. Psychomotor skills were more consistent, with compression depth (mean: 83.6), rate (mean: 113.5 compressions/min), and full release exceeding 60% (mean: 92.0) all meeting or approaching guideline-recommended standards.

Discussion

This study demonstrated that integrating peer education with simulation-based BLS practicums significantly improves nursing students' knowledge and psychomotor skills. The large effect size (Cohen's d = 1.90) observed is consistent with prior studies on simulation-based learning. Smith & Hamilton (2015) similarly found significant pre-to-post improvements in BLS simulation scores (pre: 86.10; post: 92.77) among students receiving simulation-based instruction. Asegid & Assefa (2021) also reported in a systematic review and meta-analysis that simulation-based teaching produced significant improvements in nursing skill performance, with overall effects favouring simulation interventions.

The role of peer teachers in this study was central to the observed improvement. Research by Dennis et al. (2020) found that peer-led demonstration and simulation activities facilitated better understanding and more actionable feedback during skills implementation. Peer-based interaction reduced hierarchical barriers between instructor and learner, which may explain the increased motivation and engagement observed in this study. Koukourikos et al. (2021) similarly noted that

peer-led simulation activities serve as an ongoing strategy for improving emergency nursing competencies.

The diversity of peer feedback received during the intervention also contributed to deeper learning. Stenberg & Carlson (2015) found that peer learners who received feedback from individuals of similar academic standing gained new perspectives that enhanced understanding of their field and academic engagement. In this study, peer learners appeared more comfortable and less anxious during skills assessments, consistent with Byl & Topping (2023), who noted that peer tutoring fosters motivation and sense of belonging, thereby reducing performance anxiety and competitive pressure.

Peer-led simulation practice supports positive personal development and social integration (Pålsson et al., 2017). In this study, shared learning goals among peer groups fostered a sense of community, mutual support, and collaborative problem-solving. These social dimensions of peer learning have been associated with stronger long-term academic engagement (Bugaj et al., 2019). Furthermore, Zha et al. (2019) in a meta-analysis found that peer-led learning duration, task type, and training quality all moderate its effectiveness, underscoring the importance of the structured multi-week training protocol employed in this study.

Compared with international evidence, our findings align well. Aljahany et al. (2021) and Korkut & Baser (2020) both reported positive student perceptions of peer-assisted simulation in health sciences contexts, including improved self-confidence, collaboration, and professional role appreciation. Our study extends this evidence base to an Indonesian nursing education context, where BLS competency gaps have been documented (Syafrani Nurul Islamiyah & Fida' Husain, 2024). The educational implication is clear: institutions should consider integrating structured peer education programmes into BLS curricula as a cost-effective and pedagogically sound supplement to traditional instruction.

The improvement in knowledge, while statistically significant, also revealed a meaningful floor effect: the lowest post-intervention knowledge score was 45, indicating that some students did not achieve the minimum competency benchmark. This suggests that peer education alone may not be sufficient for all learners, and that additional individualised support or remediation strategies should be embedded in the curriculum for at-risk students.

LIMITATION

Several limitations must be acknowledged. First, the quasi-experimental design without a randomised control group limits the ability to attribute improvements exclusively to the peer education intervention; confounding variables such as self-selection motivation cannot be fully ruled out. Second, peer teachers were self-selected and may not have had uniform communication skills, potentially introducing variability in intervention delivery. Although fidelity monitoring was conducted, differences in peer teacher explanatory style across groups remain a concern. Third, the sample was drawn from a single institution, limiting the generalisability of findings to other nursing programmes. Fourth, the follow-up period was short, precluding assessment of long-term retention of BLS skills. Fifth, independent verification of actual clinical behaviour change was not obtained, as assessments were conducted in a controlled laboratory environment. Future studies should address these limitations through randomised controlled designs, multicenter sampling, and longitudinal follow-up assessments.

CONCLUSION AND SUGGESTION

This quasi-experimental study demonstrated that integrating simulation-based BLS practicums with a peer education method significantly improved nursing students' knowledge and psychomotor competence, with a mean score increase of 19.5 points and a large effect size (Cohen's d = 1.90). Peer interaction during simulation practicums enhanced motivation, reduced anxiety, and fostered collaborative learning. These findings support the integration of peer education into BLS simulation curricula in nursing education. Practical recommendations for nursing educators include: (1) adopting structured peer teacher training programmes within existing laboratory resources; (2) implementing ongoing monitoring of peer teacher performance to maintain intervention quality; and (3) providing supplementary support for students who fail to meet minimum knowledge benchmarks. Future research should employ randomised controlled designs with control groups, multicenter samples, and longitudinal follow-up to provide more definitive evidence regarding the long-term effectiveness of this integrated approach.

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CONFLICT OF INTEREST

The authors report no conflict of interest in the conduct of this research.

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