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Standardized Program for Advancing Clinical Education (S.P.A.C.E.) - Effectiveness of Structured Pre-Clinical Training for Physiotherapy Education

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Abstract

This study evaluates S.P.A.C.E. program (Standardized Program for Advancing Clinical Education), a simulation-based intervention bridging classroom theory with clinical practice for physiotherapy students. It addresses challenges in translating theoretical knowledge into practical skills, alleviating student anxiety through a structured sequence of pre-training, simulated clinical experience with real-time feedback, and post-training reflection. A total of 135 undergraduate students participated the program. They were asked to complete a set of questionnaires before and after the program with items related to their perceived level of self-reported clinical confidence and competency; and specialty-specific knowledge questions. Significant increases in self-reported clinical confidence and competency as well as improvements in case-related knowledge were observed after the program. Regarding the perception of the program's usefulness in preparing them for clinical placement, the mean ratings ranged from 6.50 ± 1.66 to 7.08 ± 1.59, highlighting the S.P.A.C.E. program's effectiveness in enhancing clinical competency among physiotherapy students. The findings underscore the necessity of a structured training program to prepare students for the clinical environments they will encounter, the clinical educators they will collaborate with, and the diverse patient populations and conditions they will face during clinical placements. However, further research is needed to evaluate how such training impacts students' actual performance in real-world clinical settings.

Keywords: *Pre-clinical training, physiotherapy education, clinical education*

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1. Introduction

In today's rapidly evolving healthcare landscape, the need for highly competent and adaptable physiotherapists has never been more critical. A significant challenge in physiotherapy education lies in bridging the gap between classroom-based theory and integrated clinical practice (Petty et al., 2011; Wyres, 2019). While lectures and study materials provide the essential foundation of knowledge, many students struggle to translate this theoretical learning into practical skills required for patient care in hospital settings (Günay & Kilinç, 2018). The unpredictability of real-world clinical environments—marked by patient variability, dynamic interactions, and time pressures—often exposes limitations in traditional training methods (Burgess et al., 2019). Consequently, students may experience uncertainty and anxiety when applying classroom knowledge in high-stakes clinical scenarios (Günay & Kilinç, 2018; Petty et al., 2011).

Traditional approaches, such as peer role-playing and manikin-based simulations, have long been utilized to bridge this gap. However, these methods often fail to replicate the nuanced complexities of authentic patient interactions (Pritchard et al., 2020; Sherwood & Francis, 2018). The simulated environments they offer tend to lack the unpredictability and emotional depth of real clinical situations, thereby limiting students' preparedness for the demands of actual practice (Pritchard et al., 2020). Furthermore, the lack of standardized procedures and immediate, structured feedback often hinders the development of confidence and critical decision-making skills—qualities that are essential for independent clinical practice (Hoffmann et al., 2019).

In response to these challenges, **the Standardized Program for Advancing Clinical Education (S.P.A.C.E.)** program was developed. This innovative training framework aims not only enhance the integration of theoretical and practical knowledge but also empower students to overcome the fear and hesitation that hinder performance. Many students feel constrained by anxiety about meeting the high standards expected of seasoned practitioners, which can prevent them from fully realizing their potential during patient assessments and treatments (Edgar, 2015; Petty et al., 2011). The S.P.A.C.E. program directly addresses these concerns by providing a controlled yet realistic simulation environment where students can practice essential clinical skills. This structured program offers a comprehensive pathway for building confidence and competency.

Grounded in established educational theories—including Cognitive Load Theory, Experiential Learning Theory, and Social Cognitive Theory—the S.P.A.C.E. program optimizes the learning process (Kirschner et al., 2018; Mukhalalati et al., 2022; Sewell et al., 2018). By equipping students with foundational knowledge, engaging them in realistic clinical scenarios, and facilitating immediate constructive feedback, the program enables learners to effectively bridge the gap between theory and practice. The ultimate goal is to cultivate a generation of

physiotherapists who are not only technically proficient but also confident, adaptable, and prepared to excel in clinical settings.

The primary objective of this study was to evaluate the effectiveness of the S.P.A.C.E. program in enhancing clinical competencies among physiotherapy students. We hypothesized that this structured, simulation-based training approach would significantly improve students' clinical reasoning, practical skills, and overall confidence compared to traditional methods. The implications for physiotherapy education, this research offers insights into modernizing clinical training methodologies across allied health professions.

2. Methodology

This was a quasi-experimental study which examined the experience change after the S.P.A.C.E. program.

2.1. Procedures

2.1.1. Participants

All senior physiotherapy students were invited to participate in the S.P.A.C.E. pre-clinical training program before their clinical placements. Study details were explained to participants, and written informed consent was obtained before commencement. A total of 135 students (mean age: 21.64 ± 1.72 years) enrolled in the program. Participants were assigned to one of three specialties based on their clinical placement allocations: Cardiopulmonary (Cardio) (n = 45), Musculoskeletal (MSK) (n = 44), and Neurological (Neuro) (n = 46). The S.P.A.C.E. program simulated specialty-specific clinical environments mirroring hospital placement settings. The program comprised four key steps:

1) Pre-program quiz: Assessed specialty-specific knowledge and allowed students time to plan management strategies for two cases (Case A and Case B) within their assigned specialty.
2) Simulation training: Students worked in pairs to manage cases using standardized patients (trained actors portraying symptoms for MSK and Neuro cases) or manikins (for Cardio cases).
3) Debriefing: Teaching faculty provided feedback in styles reflecting real-world educator approaches (e.g., end-of-session feedback or mid-session feedback at critical moments).
4) Post-program quiz: Repeated the pre-program questions to evaluate if any knowledge gained.

2.1.2. Evaluation

Participants were asked to provide demographic data (age, gender) and report self-perceived level of stress before the S.P.A.C.E. program. Program effectiveness was assessed via a pre- and post-program survey evaluating 1) Readiness for clinical practice, 2) Self-perceived

confidence and competency and 3) Communication skills. Each item was rated on an 11-point scale (0 indicating no confidence/ competency; 10 indicating full confidence/ competency).

2.2. Statistical analysis

All continuous data were presented as mean ± standard deviation (SD). Paired t-tests were used to examine if any change in self-reported clinical confidence/ competency and specialty-specific knowledge pre- and post- program. One-way analysis of variance (ANOVA) was used to compare the students' feedback on the program across specialties (Cardio, MSK, Neuro). Significance was set at $p < 0.05$. All data were analyzed by statistical package (IBM SPSS Statistics for Windows, Version 29.0.2.0 Armonk, NY: IBM Corp).

3. Results

3.1. Self-reported clinical confidence and competency

Mean confidence and competency scores increased from 5.79 ± 1.30 (pre-program) to 6.33 ± 1.51 (post-program). Paired t-tests revealed significant improvements in most items ($p < 0.05$), except for items 5 and 18 (Table 1). These results suggest enhanced confidence and competency across most domains post-program.

3.2. Specialty-specific knowledge

A total of 6 cases, i.e., 2 cases per specialty were developed in S.P.A.C.E. Significant knowledge improvements were observed when students in Cardio group answered Case B with score increased from 15.50 ± 8.46 to 22.25 ± 8.91 ($t = 4.52$, $p < 0.001$) and those in Neuro group answered Case A with score increased from 21.71 ± 11.81 to 25.61 ± 9.76 ($t = 3.24$, $p = 0.002$). No change was observed in other cases.

3.3. Program feedback

On a 0–10 scale, participants generally held favorable views of the program. Overall, the mean scores ranged from 6.50 ± 1.66 to 7.08 ± 1.59 indicating moderately high ratings. Except for item (i.e., The patient actor portrayed the role of a patient in a realistic manner), there were no differences in all post program feedback score across the 3 specialties. The differences in Item 4, i.e., significantly lower in Cardio than the other 2 groups could be explained by the fact that Cardio adopted manikin which had no facial expression while the other two specialties adopted Standardized patient, i.e., trained actor who had facial expression mimicking real patient's responses. These suggest that manikin's limitation.

Table 1. Self-reported clinical confidence.

Items on confident and competent	Pre-program	Post-program
1. I feel confident in my ability to complete this activity to a high standard.	5.20 ± 1.72	5.66 ± 1.71**
2. I feel prepared for clinical placement in the area of physiotherapy.	5.08 ± 1.64	5.75 ± 1.71**
3. I am aware of my strengths in this role playing.	5.33 ± 1.64	6.01 ± 1.70**
4. I can identify areas of weakness related to this activity where I would benefit from further preparation for clinical placement.	6.17 ± 1.59	6.98 ± 1.76**
5. I feel confident in my ability to establish rapport with a client.	6.45 ± 1.60	6.57 ± 1.69
6. I feel confident I can use interpersonal skills such as reflective listening and appropriate use of questions when interacting with real clients.	6.36 ± 1.62	6.57 ± 1.60*
7. I feel confident that I can provide information and education to clients.	5.95 ± 1.47	6.45 ± 1.61**
8. I feel confident in my ability to use appropriate handling and practical skills with this client type.	5.34 ± 1.48	6.27 ± 1.64**
9. I feel confident I can interact in a professional manner.	5.99 ± 1.64	6.49 ± 1.70**
10. I feel confident I can identify key problems during an assessment.	5.54 ± 1.54	6.28 ± 1.75**
11. I feel competent in expressing my clinical reasoning and treatment plans to my CE.	5.24 ± 1.60	6.00 ± 1.79**
12. I feel comfortable in asking my CE for guidance when facing challenges during patient management.	5.65 ± 1.65	6.31 ± 1.84**
13. I feel comfortable when receiving feedbacks from CE.	5.90 ± 1.79	6.68 ± 1.81**
14. I feel competent to explain treatment plans to patients in a way they can understand.	6.02 ± 1.52	6.41 ± 1.63**
15. I am prepared to address patients' questions, concerns, or emotions during treatment.	5.78 ± 1.65	6.32 ± 1.62**
16. I am competent in building trust with patients through effective and respectful communication.	6.20 ± 1.62	6.52 ± 1.56**
17. I feel confident to be aware of the potential danger during patient management.	6.09 ± 1.56	6.36 ± 1.63*
18. I feel confident that I can ensure patient's safety	6.34 ± 1.67	7.08 ± 6.33
19. I feel competent to handle emergencies and unexpected patient conditions.	5.29 ± 1.73	6.02 ± 1.83**

Note. Data were presented as mean ± standard deviation (SD), * indicates $p<0.05$ and ** indicates $p<0.01$ as assessed by paired t-test.

Table 2. Scores on the program feedback

Items		Overall	Cardio	MSK	Neuro
1.	This program has provided me with experience to familiar with the real-life clinical environment.	6.81 ± 1.64	6.96 ± 1.36	6.79 ± 2.08	6.69 ± 1.44
2.	My self-confidence in performing assessment and treatment under supervision has been increased.	6.50 ± 1.66	6.60 ± 1.14	6.37 ± 2.16	6.53 ± 1.59
3.	I feel that the simulated patient scenarios have enhanced my readiness for real-life clinical placements.	6.82 ± 1.53	6.98 ± 1.34	6.77 ± 1.72	6.71 ± 1.53
4.	The patient actor portrayed the role of a patient in a realistic manner.	7.08 ± 1.59	6.38 ± 1.57	7.44 ± 1.68	7.44 ± 1.29
5.	The SPACE program is very helpful to prepare for my clinical placement.	7.03 ± 1.46	7.18 ± 1.21	6.95 ± 1.69	6.96 ± 1.48

Note. Data were presented as mean ± standard deviation (SD)

4. Discussion

The S.P.A.C.E. program effectively enhanced students' self-perceived confidence and competency in patient management, preparing them for clinical placements. Yet, the suboptimal and inconsistent results observed in specialty-specific knowledge assessments may stem from limitations in question design and content. To better evaluate knowledge improvement in this domain, future iterations of the program should integrate case management-focused questions, ensuring a fairer and more targeted assessment of competency.

Unlike static manikins—which lack facial expressions, ambulatory functions (e.g., walking), and realistic patient responses—the use of standardized patients (trained actors) resolved these limitations, creating an immersive clinical practice experience. This approach allowed students to engage in realistic scenarios mirroring actual clinical environments, where they practiced interacting with patients, interpreting their responses, and managing dynamic conditions. Early exposure to such simulations provided psychological and mental preparation for subsequent clinical placements.

Additionally, the program addressed hierarchical and power dynamics that often deter students from seeking feedback (Findyartin et al., 2023). Many students hesitate to ask questions due to fears of appearing incompetent or negatively impacting their performance evaluations, particularly when concerns involve "naïve" inquiries. The S.P.A.C.E. program also simulated diverse feedback styles used by clinical educators—such as sarcastic, questioning, or challenging tones, as well as variations in timing (mid-session vs. end-of-session feedback) and

delivery modes (directive vs. reflective). By training students to navigate these interactions, the program encouraged self-reflection, identification of strengths and weaknesses, and adaptation to educators' communication styles. This reduced anxiety around feedback-seeking and fostered skills to reinforce effective practices while addressing areas for improvement.

5. Conclusion

The findings underscore the necessity of a structured training program to prepare students for the clinical environments they will encounter, the clinical educators they will collaborate with, and the diverse patient populations and conditions they will face during clinical placements. However, further research is needed to evaluate how such training impacts students' actual performance in real-world clinical settings.

6. Ethical approval

Study approval was obtained from the institutional review board of The Hong Kong Polytechnic University (HSEARS20241230007).

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