

ORIGINAL RESEARCH ARTICLE

Supplementing acute care clinical education experiences with simulation-based learning: a pilot study

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Abstract

Rationale: Physical therapist (PT) educational programs must prepare students to practice across the continuum of care, but students often lack confidence in the acute care setting. The purpose of this report is to describe a pilot study aimed at exploring a simulation-based learning experience (SBLE) as a complement to an acute care clinical experience (CE) and its effect on student performance and confidence.

Methods: In this quasi-experimental cohort pilot study, the performance and confidence of three students (intervention group-IG) participating in a supplemental SBLE, while completing their final CE in an acute care setting, were compared to six students (control group-CG) who did not participate in the SBLE. The Acute Care Confidence Survey and the Clinical Performance Instrument (CPI) 2.0 were utilized to assess four learning competencies: Safety, Communication, Patient Management, and Clinical Reasoning.

Results: At midterm and final CPI ratings, the IG showed a trend towards higher scores than the CG in 60% of the relevant categories. Participants in the IG showed similar confidence scores to participants in the CG at the end of the CE.

Discussion and conclusion: This project provided an opportunity for students to self-reflect as part of the SBLE on their patient management, in the acute care setting, with guidance by faculty. This project adds to the evidence on how simulation-based learning can complement physical therapy clinical education.

Keywords: *clinical education; simulation; acute care; clinical experience; student performance; student confidence*

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Clinical education is an integral component of the Doctor of Physical Therapy (DPT) curriculum. The Commission on Accreditation in Physical Therapy Education (CAPTE) requires a minimum of 30 weeks of full-time clinical education experiences.¹ DPT students must be exposed to the management of patients across the lifespan and continuum of care and are expected to meet entry-level (EL) clinical performance prior to graduation.¹

The 2022–2023 United States Bureau of Labor Statistics reports that 28% of physical therapists (PT) are

employed in hospitals systems and approximately 10% of PTs identify as working in the acute care setting.^{2,3} PTs practicing in the acute care setting play an important role in reducing length of stay and hospital readmission rates, key systems-based indicators related to cost and safety.^{4–6} To increase the number of PTs practicing in the acute care setting, educational programs must prepare students to practice confidently in this setting. Due to the complexity and skills required in all learning domains (affective, cognitive and psychomotor), at times, students lack confidence in this setting.^{7–9} As a result of these challenges,

innovations in acute care clinical training programs have emerged.¹⁰⁻¹²

The utilization of simulation-based learning experiences (SBLE) has been adopted by healthcare educators to mirror real life situations.¹³⁻¹⁶ Evidence suggests that simulation-based learning (SBL) can provide an opportunity to increase confidence and improve students' psychomotor and technical skills necessary in the acute setting.^{7,9,11,12} Additionally, SBL provides opportunities to integrate content knowledge, clinical skills, and critical thinking in a realistic non-threatening safe environment.^{7,12}

SBL is mostly described to be used in PT education within the academic program, prior to participation in clinical education experiences⁹⁻¹²; however, relatively few studies address supplementing clinical education during an acute care clinical experience (CE). Two studies evaluated PT students participating in SBL as part of a CE.^{10,17} The first study investigated the use of SBL with students who participated in a 4-week acute care cardiorespiratory clinical placement.¹⁰ The study compared two different models; in the first model, students participated in 1 week of simulated learning followed by 3 weeks in the clinical environment. In the second model, the SBLE was interspersed during the first 2 weeks of the 4-week CE.¹⁰ The second study utilized the same two models described earlier in the text, during a CE in an ambulatory setting.¹⁷ Both studies found that the PT students who participated in the SBLE attained competencies comparable to those in the traditional 4-week clinical immersion. Another study reported that PT student's confidence in acute care practice increased after participating in high fidelity human simulation prior to an acute care clinical education experience.¹¹

The two studies that utilized SBL as part of CEs in physical therapy were based in Australia and specific to a practice setting. Both studies collected information on student confidence using a questionnaire developed specifically for their study. No other study was found describing the integration of SBL into a full-time clinical education experience in the acute care setting with a validated confidence assessment tool.

Therefore, the purposes of this report were to describe a pilot study aimed at exploring a SBLE as a supplement to an acute care CE and to describe the effect on student performance and student self-confidence. At a time when acute care CEs are increasingly difficult to acquire for entry level students, using simulation to supplement experiential learning may improve student confidence and readiness to practice in this setting.

Methods

Setting and participants

Clinical education comprises 33 weeks in the University of Miami Doctor of Physical Therapy (UMDPT)

curriculum, accounting for about one fifth of the total curriculum. Students must complete one of the terminal CE in an inpatient setting, either acute care, inpatient rehabilitation, or a skilled nursing facility.

A sample of convenience of 12 third-year DPT students completing an 8-week terminal CE in an acute care setting in Miami Dade County, were recruited. Two students had previous acute care experience and were excluded from the study. Six students completing their CE outside of the study area consented to participate in the study and represented the control group (CG). Ultimately, four students were eligible to participate in the SBLE, attended a study information session via the Zoom platform, consented to participate, and formed the intervention group (IG). One of the four students was not able to attend all the SBLE activities and therefore these data were not used in the reporting and analysis. The University of Miami Internal Review Board approved this study protocol.

SBLE design

The SBLE design included a pre-Objective Structured Clinical Examination (OSCE), four case-based patient management simulations emphasizing four different competencies, and a post-OSCE (Supplement 1). The OSCEs were based on scenarios that included aspects of all four competencies: safety, communication, patient management, and clinical reasoning. To improve the fidelity and extent to which the simulation experience mimicked the characteristics of an authentic CE, the SBLE took place at the School of Nursing Simulation Hospital (SNSH) using simulated patient (SP) methodology or high-fidelity mannequin simulators.

The SBLE was completed on six alternating mornings during the first 2 weeks of the students' final CE. Prior to the SBLE, the IG was provided prompts to review relevant previously presented class materials including videos or handouts about communication skills, breathing exercises, bed mobility, transfer skills, vital signs, vascular assessment, sternal precautions, the Richmond Agitation-Sedation Scale (RASS), and lab reference values.

A variety of medical diagnoses, complexity, equipment needs, number of SPs/mannequins, and total number of cases needed for the SBLE were considered for case development. Three cases of patients with coronary artery bypass graft, cerebral vascular accident, and a multi-trauma orthopedic motor vehicle accident were created. These three cases were used throughout the SBLE with changes in the presentation and complexity based on the competency being assessed. For example, on one the competency assessed was safety. The motor vehicle accident case was presented with the focus on maintaining the weight bearing (WB) restrictions. On day 3, when assessing the communication competency, the patient presented as impulsive, jeopardizing the WB restrictions. On day 4,

when assessing the student's patient management skills competency, the patient presents with signs and symptoms of a potential pulmonary embolism. Students received a case summary including past medical and social history, prior level of functioning, medications, lab/test results, precautions, review of body systems, affect/behavior/cognition, PT orders, previous PT sessions, and expectations for the day's session. A sample of the cases can be found in Supplement 1.

Four UMDPT faculty members were randomly paired with a student from the IG and role-played as Clinical Instructor (CI) during the SBLE. The four pairs (faculty/student pair) were divided into two groupings consisting of two faculty CIs/two students. During the SBLE, one faculty/student pair performed the simulation case scenario while the other faculty/student pair within their grouping observed from a control room. During the simulation, the faculty member remained in the role of CI while the student executed the intervention. The two faculty CI/student groupings remained consistent throughout the study. A description of the daily schedule can be found in Table 1.

On day 1, students were oriented to the facility, equipment, process, and the SBLE objectives. A 'fiction contract' of suspending disbelief and accepting the simulation environment as reality by performing as they would in their clinical setting was discussed.¹⁸ The Plus/Delta tool, a debriefing model using guiding questions to facilitate student self-reflection on the areas they performed well, as well as opportunities for improvement, was explained.¹⁹⁻²¹ The orientation was followed by the faculty performing a simulation. During this simulation, the faculty demonstrated a pre-briefing, treatment session, and

a debriefing utilizing the Plus/Delta model. The scenario was then repeated, followed by a second debriefing. This was intended to orient the students to the SBLE process.

After the faculty simulation, each student performed a pre-OSCE. For this pre-OSCE, each pair of CI/student had a pre-brief session where the student summarized the background information, plan of care, and their planned intervention. The faculty member in their role-playing as CI, asked probing questions and provided guidance as needed prior to the intervention. The students' first performance established a baseline score using a rubric (Supplement 2) created by the investigators and was considered the pre-OSCE score. This was followed by a debriefing session between each CI/student pair utilizing the Plus/Delta model. Researchers had been previously trained in the Plus/Delta model of debriefing to ensure consistency. During this debriefing the faculty member in their role as the CI, reinforced and added to the student's reflection and discussed the action oriented and achievable goals for improvement that could be met during the second performance. The student performed the treatment session again, which was followed by another CI/student debriefing session. Ultimately, a final group debriefing session was conducted to discuss all students' overall feelings of the SBLE.

Days 2–5 focused on completing one competency per day: safety, communication, patient management, and clinical reasoning. Students were assigned different cases, and each CI/student pair contributed to the debriefing session for the other members of their group.

Day 6, each student was assigned a comprehensive case that addressed all four competencies. This final simulation was performed twice as on previous days, but only the

Table 1. Schedule of simulation activities

Day 1	Schedule of simulation activities	Day 2	Day 3	Day 4	Day 5	Day 6
Orientation	Schedule for Days 2–5	Case 1: Safety	Case 2: Communication	Case 3: Patient management	Case 4: Clinical reasoning	Post OSCE
Faculty case demonstration	10 min	Student #1 Pre-brief	Student #1 Pre-brief	Student #1 Pre-brief	Student #1 Pre-brief	Post OSCE Pre-brief
Pre-brief Faculty demonstration	30 min	Simulation Student #1	Simulation Student #1	Simulation Student #1	Simulation Student #1	Simulation – all students
Pre OSCE All students	15 min	+/Delta debrief Student #1	+/Delta Debrief Student #1	+/Delta debrief Student #1	+/Delta debrief Student #1	+/Delta debrief Each student with CI
+/Delta debrief Each student with CI	20 min	Repeat Simulation Student #1	Repeat Simulation Student #1	Repeat Simulation Student #1	Repeat Simulation Student #1	Repeat post-OSCE All students
Repeat pre-OSCE All students	10 min	+/Delta debrief Student #1	+/Delta debrief Student #1	+/Delta debrief Student #1	+/Delta debrief Student #1	+/Delta debrief Each student with CI
+/Delta debrief Each student with CI with different case	Repeat sequence with different case	Repeat with Student #2 Different case	Group debrief Reflection			
Group debrief	Group debrief	Group debrief	Group debrief	Group debrief	Group debrief	Group debrief
Reflection	Reflection	Reflection	Reflection	Reflection	Reflection	Reflection

OSCE: objective structured clinical examination; CI: clinical instructor.

first performance was utilized to assess changes in performance compared to the pre-OSCE score. Both the pre and post-OSCE cases were the same for all students.

At the end of each day, students and investigators came together for a group debrief sharing the overall impressions of the day. Students and investigators were asked to complete a daily self-reflection consisting of three questions developed by the investigators: (1) overall impression of the day, (2) what went well on that day, (3) what they would do differently next time. This was an informal exercise intended to reinforce reflective learning and practice.

Scenario simulators and SP training

On Day 3, a high-fidelity mannequin was utilized in the case of a lightly sedated patient. Two simulated participants were incorporated in this case, one as a nurse and one as the patient's mother. For all other cases, SP methodology was utilized, and the SPs were trained in three 1-hour sessions. During these sessions, the cases were demonstrated by the investigators, then the case was repeated by the SP. The SPs were given feedback on their performance and had opportunities to ask questions. Key learning objectives for each case were emphasized for consistency.

Study outcomes

The Acute Care Confidence Survey (ACCS)^{11,22,23} and the Clinical Performance Instrument (CPI) 2.0^{24,25} were utilized to determine four learning competencies and outcomes to be assessed. Both instruments have demonstrated reliability and validity.²²⁻²⁴ The ACCS is a reliable and valid instrument which queries respondents about their confidence in performing 15 items relevant to the acute care setting.²²

The four CPI competencies deemed essential to successful patient outcomes included: (1) Safety, (2) Communication, (3) Patient management and (4) Clinical reasoning.

In addition to these primary outcomes, several performance criteria were specified and assessed for each competency. The investigators developed a scoring rubric to assess each competency utilizing the ACCS and the CPI 2.0 (Supplement 2). The rubric was used to compare the student's performance in the pre- and post- OSCE and the first and second performance of each daily case.

The students received a check mark and assigned a numeric value based on whether expectations for performance of each objective were 'met' (2), 'needed improvement' (1), 'not met' (0), or were not applicable 'N/A'. The total was translated into a percentage comparing changes in performances between the two performances. Thus, 100% means that the student met expectations for each item in the rubric, and 0% means that they did not meet expectations for any of the items in the rubric. Students from the IG and CG were asked to complete the ACCS prior to the start of the CE, after 2 weeks of the CE/end of the SBLE, and at the conclusion of the CE. Data were also collected from the CPI as required for both the IG and CG. The schedule for outcome collection can be found in Table 2.

Data analysis

We calculated median scores at midterm and final assessment for relevant items of the ACCS and CPI for students the CG ($n = 6$). These median scores were compared to individual scores for the intervention students ($n = 3$). For each student in the IG, we calculated individual scores for the pre-SBLE OSCE, each case of the SBLE, and the post-SBLE OSCE.

Results

Results of the CPI can be found in Fig. 1. The three students in the IG met or exceeded the median CPI scores of students in the CG at midterm in 7 of the 10 items. A score of 8 in the CPI indicates EL. Scores greater than 8 indicate that students exceeded EL expectations. At the final assessment, students in the CG had a median score of 8 in all 10 CPI items, meaning that half of the students in the CG had scores of 8 or below while all three students in the IG had a score of 9 or 10 in all but one of the 10 CPI items.

ACCS scores at three time points are summarized in Fig. 2. In general, students in the IG indicated less confidence than the CG for most categories prior to the SBLE but showed improvements in confidence after the SBLE which were similar to the CG. At the end of the CE, students in the IG showed similar confidence scores in most categories as compared to the CG.

The results of the OSCE and the daily cases are found in Fig. 3. All three IG students showed improvements

Table 2. Schedule of outcomes measured

Measured outcomes schedule	Day 0 Pre-SBLE	Week 2 Post-SBLE	Week 4 Midterm	Week 8 Final
Intervention group	ACCS	ACCS	Midterm CPI	Final CPI ACCS
Control group	ACCS	ACCS	Midterm CPI	Final CPI ACCS

SBLE: simulation based learning experience; ACCS: Acute Care Confidence Survey; CPI: Clinical Performance Instrument.

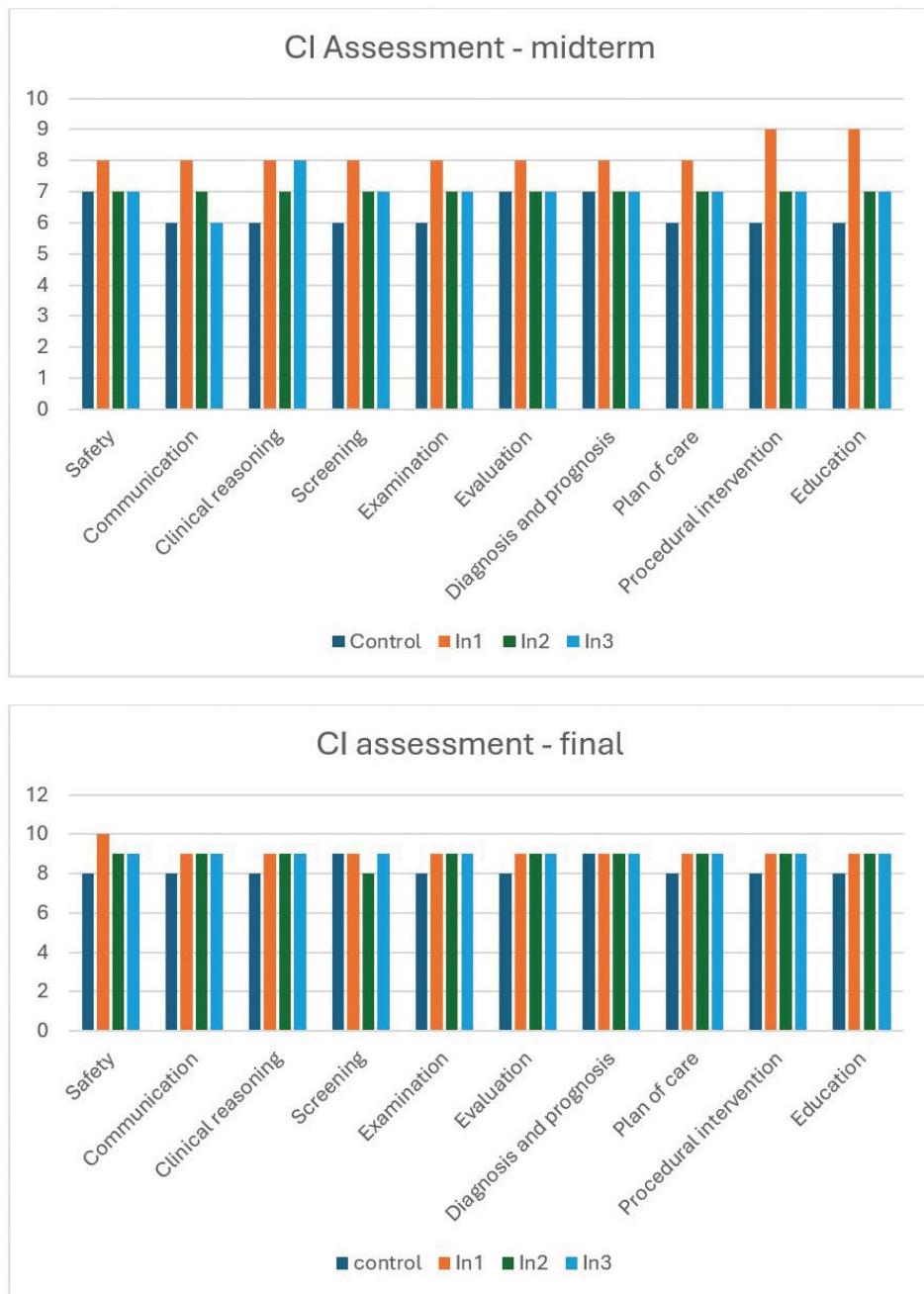


Fig. 1. CPI scores at midterm and final for control group and individual intervention group participants. CPI, clinical performance instrument; CI, clinical instructor; In, intervention.

between the pre- and post-OSCE in the cases focusing on communication, safety, and patient management. Two of the three students showed improvements in performance of the clinical reasoning case.

Discussion

This pilot study found that students participating in an 18-hour SBLE supplementing a full-time acute care CE may demonstrate better clinical performance than students who did not participate in the SBLE. Unlike other

health professions that commonly complete SBLE during CE time,¹⁶ PT education typically integrates SBLE into the academic courses before a CE or after returning from an integrated CE prior to completing all the didactic work. To our knowledge, only two studies have integrated the SBLE in physical therapy education^{10,17} within the time-frame of the CE and only one focused on acute care.¹⁰ In these studies, PT student participants spent 25% of their CE in the SBLE and the results report similar improvements in clinical performance between their IG receiving

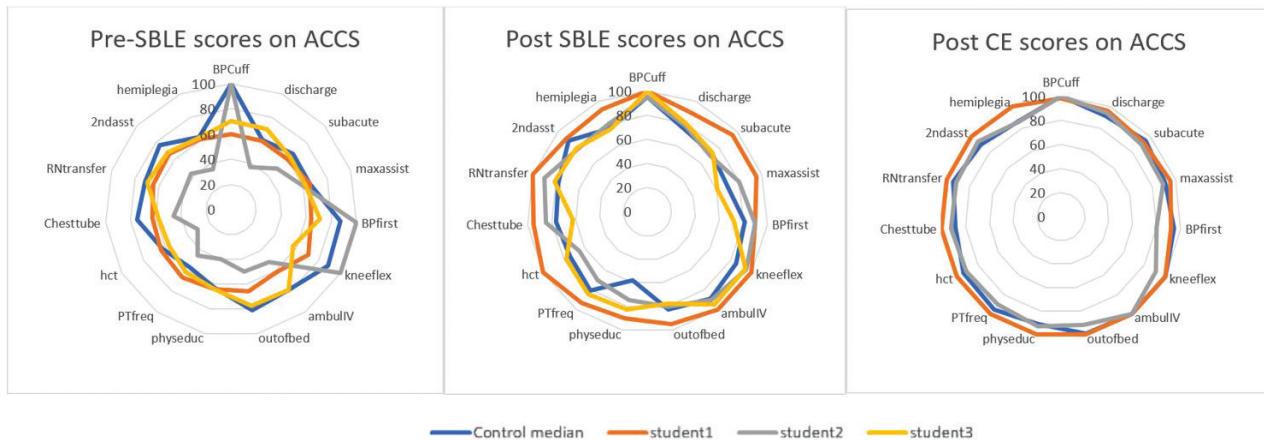


Fig. 2. Spider plots demonstrating Acute Care Confidence Survey scores for each of the students in the intervention group as compared to the median score of the control group.

SBLE, simulation based learning experience; ACCS, Acute Care Confidence Survey; CE, Clinical experience; BPCuff, put a blood pressure cuff on correctly; discharge, safe for discharge home; subacute, decide if a person needs subacute rehab; max-assist, perform a max assist transfer; BPfirst, hear the first sound of a blood pressure; kneeflex, measure knee flexion; ambulIV, ambulate with an IV; outofbed, out of bed after a hip replacement; physeduc, educate a physician that a patient does not need physical therapy; PTfreq, determine the frequency of physical therapy; hct, interpret hematocrit; chesttube, assist supine to sitting with a chest tube; RNtransfer, education a nurse about toe-touch weight bearing transfer; 2ndasst, identify when a second assistant is needed; hemiplegia, position a patient with hemiplegia in bed.

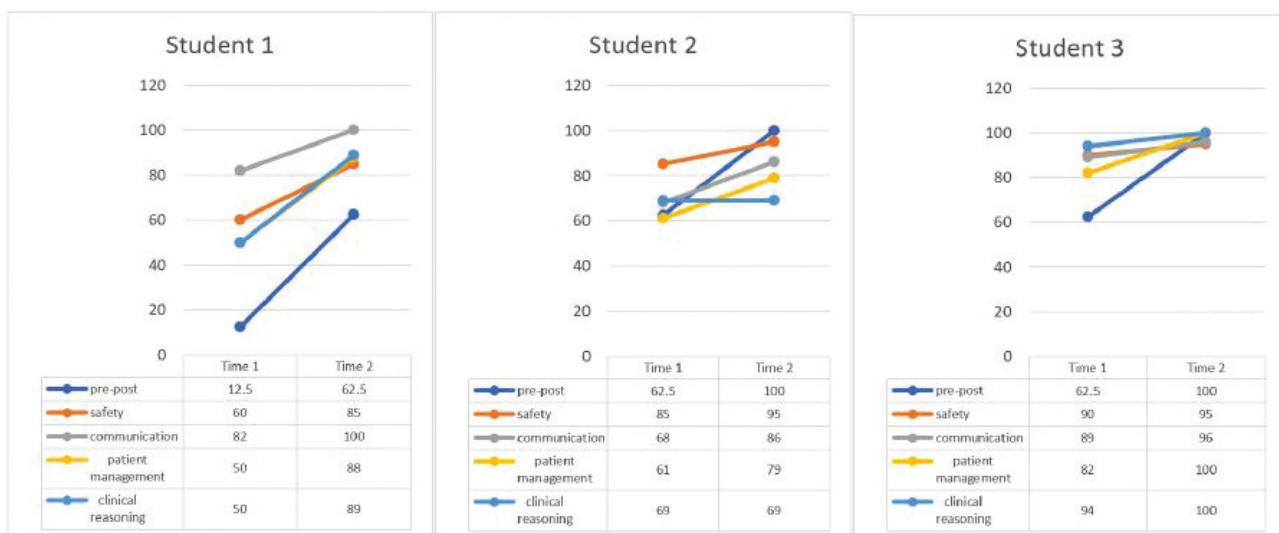


Fig. 3. Results of the pre-post OSCE and the two performances of each objective-focused case.
OSCE, objective structured clinical examination.

the SBLE and the CG not receiving the SBLE.^{10,17} In the current study students spent 7% of their CE in the SBLE, yet the IG demonstrated similar or better scores in their clinical performance midway through the CE and similar confidence levels by the conclusion of the CE in the acute care setting. This study adds to the limited data that integrating SBLE into the CE timeframe offers an alternative to the traditional model of clinical training in DPT education.

This SBLE was integrated into the CE and the investigators used the CPI scores provided by the student's acute care CI to capture potential carryover in performance. We found the students in the IG exceeded the median CPI scores of students in the CG at midterm in 7 of the 10 categories. At the final CPI assessment, all students met entry level expectations for all categories; however, the IG had higher median scores in 6 of the 10 categories and achieved 'beyond entry level' in more categories than the CG. In other studies where

the SBLE was incorporated during the CE, it is reported there was no significant difference in the student's competency to practice performance tool.^{10,17} Previous studies also included two models. The first model had the students performing only SBLE during the first week followed by 3 weeks of clinical practice, whereas the second model had students completing a mixture of SBLE and clinical practice during the first 2 weeks followed by 2 weeks of clinical practice.^{10,17} These studies second model is comparable to our format. Blackstock et al.¹⁰ found that while the performance tool outcome was not significantly different between the two models or the CG, the students in the second model, where SBLE was dispersed, achieved a higher score in 5 of 7 Assessment of Physiotherapy Practice standards. Their findings support what we observed in our students.

The ACCS results showed that the IG had lower confidence compared to the CG before the SBLE, and similar confidence after the 2 weeks of the SBLE and at the end of the CE. It is possible that the IG was more critical of their initial confidence level knowing they were completing a novel SBLE and being evaluated by their faculty. The IG received feedback from two faculty members and a peer during the SBLE. The IG's confidence level increased at a faster rate compared to the CG and at the end of the CE slightly exceeded that of the CG. Other researchers have found that PT students reported increased confidence levels in the acute care setting after completing an SBLE which took place before the CE started.^{11,26} Similar to our results, they also found that both the IG and CG showed similar increases in confidence after completing their CE.¹¹ Our IG students appeared to have lower confidence levels prior to the SBLE, but they demonstrated accelerated rates of improvement in confidence and equivalent levels at the end of the CE suggesting that integrating the SBLE into the CE may lead to better initial self-assessment and ultimately greater gains in confidence.

Stockert et al.²⁶ reported that despite increased use of simulation in PT education, few studies adhere to the standards of best practice (SOBP) developed by the International Nursing Association for Clinical Simulation and Learning (INACSL) and the Association of Standardized Patient Educators.^{26,27} The scoping review looked for three critical elements from the SOBP; a needs assessment, pre-briefing, and debriefing, and additionally, the presence of standardized valid and reliable outcome measures in the studies. They found that less than half of the studies included both a pre- and debriefing and only 26% used standardized outcome measures.²⁶ Our study adheres to recommendations set by the SOBP by utilizing pre-briefing, debriefing, and standardized outcome measures to assess the effectiveness of the SBLE. While we did not do a formal needs assessment, the four competency domains were selected by the clinical education team with a range between 7 and over 30 years of experience in clinical education.

To our knowledge, our study is the first to offer physical therapy students the opportunity to repeat the same case after the debriefing. This format has been previously reported on in both nursing and medical education research, concluding that this technique was effective in improving self-efficacy, encouraging mastery of a concept, and improving muscle memory and long-term memory development.^{28,29} This opportunity supported the consistent improvement in performance scores seen between the first and second attempt. Students also reported finding this aspect of the SBLE to be beneficial. We believe this to be a highlight of our study as the changes we saw in the students' confidence level may be attributed to this component more than the SBLE experience itself.

This study included a structured Plus/Delta debriefing format which included the faculty member acting as the CI and another student/faculty pair. Including peer feedback as part of the debriefing process provided an additional learning opportunity for the student observer and allowed the practicing student to receive feedback from a peer, possibly yielding an enhanced learning experience.

This study found that the IG's overall CPI scores trended higher at midterm and final compared to the CG. It is possible that the IG's acute care CIs were influenced by the knowledge that their student was participating in this study and therefore graded them more generously.

We feel that the study describes a novel educational intervention and that the outcomes were captured using validated tools that measure both clinical performance and student confidence. The major limitation of this pilot study was the fact that there were only three students in the IG, making it not possible to run statistical tests. In addition, the study was conducted at a single institution limiting the generalizability to other programs or settings. Another limitation was that the design was not randomized; thus the groups may not have had equivalent experiences. Finally, there may have been an unconscious bias by the faculty evaluators who expected improvements in the student's performance.

This pilot study was resource-and labor-intensive given such a small sample size. Future research could include an SBLE within a shorter timeframe, utilizing fewer resources, and collaboration between multiple institutions to increase the sample size. A needs assessment should also be conducted prior to designing the grading rubric and cases to reflect the needs of each institution. Lastly, including a focus group discussion as part of the study would provide more insight from students on which components of the SBLE were most effective. Additionally, future studies could compare outcomes of SBLEs prior to versus within CEs to determine which leads to better outcomes.

Conclusion

This pilot study contributes to the discussion of using SBLE as a supplement to clinical education. Students

participating in the SBLE showed a trend towards better performance in some categories of the CPI and expressed similar confidence levels in some acute care skills. This project required significant time and resource commitment that may not be available at other institutions.

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