



Research Article

# Effective Simulation in PT Education on Student Perception of Diabetes Treatment

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## Abstract

**Purpose:** While patient simulation has been widely implemented in the instruction of medical students, it has been underutilized in physical therapy programs. This aims to investigate whether simulations can assist in the education of students and improve student confidence in various clinical skills.

**Case description:** A class of physical therapy students participated in patient simulation as part of their course. Surveys were completed by students before and after the simulation to measure student confidence in knowledge and skills, patient education, assessment, and exam interpretation.

**Outcomes:** Eighty-nine percent of students (n=44) successfully completed all study surveys before and after simulations were held. Student confidence in knowledge and skills, patient education, assessment, and exam interpretation significantly increased post-simulation ( $p < .001$ ). All students agreed that patient simulation should be more widely used in physical therapy curriculum.

**Discussion:** Results demonstrate how patient simulation may facilitate physical therapy education and improve student confidence in various clinical skills. Prospective research might better ascertain how patient simulation prepares physical therapy students for the clinical environment and strengthens their performance in the clinical setting long-term with larger sample sizes and more objective measures.

**Keywords:** Patient simulation; Standardized patient; Physical therapy; Student education; Diabetes mellitus

## Introduction

Healthcare has grown substantially in recent years on behalf of an aging population and considerable population growth [1]. Since the occurrence of COVID-19, hospitals have reported insufficient numbers of available beds and staff [2]. This has led to a greater need for physical therapists in particular, considering the reduced length of hospital stays associated with early mobilization [3]. However, clinical placements for physical therapy students were severely limited as a result of the pandemic despite the urgency for their services [4].

Prior to graduation, it is necessary for physical therapy students to manifest entry-level clinical skills [5]. In order to meet

the requirements established by the Commission on Accreditation in Physical Therapy Education, physical therapist education programs provide a minimum of thirty weeks of clinical education [5,6]. However, it is estimated that only a fifth of students' curriculum is dedicated to their clinical education, while the remainder is didactic according to the American Physical Therapy Association [7]. It is essential that academia integrates new learning techniques into class and laboratory time to better prepare students for the clinical environment.

Simulations provide real experiences in a guided and interactive manner to prepare students for real-life encounters [8,9]. These are sound educational tools for developing students' clinical skills [8,10-12] and have effectively replaced parts of clinical training [12,13]. Standardized patients (SP) are commonly employed to portray patient case scenarios in simulations [12,14,15]. Such as presenting an illness of their own or a mock

case scenario, situations that are commonly encountered in a clinic [[14,15]]. In either case, SPs are trained by educators to ensure that each condition is depicted in a standard fashion [14,15].

Results in this study determined how simulations performed with SPs would affect the confidence and satisfaction of physical therapy students learning about diabetic foot care. We hypothesized that student confidence would improve after participation in a simulation. In addition, we predicted that most students would be satisfied with patient simulations as an academic exercise.

There are several methods of experiential learning that occur both in and out of the classroom [6]. Among these, patient simulation is one of many benefits that allow students to master their skills without fear of doing harm [6]. Patient simulation is referenced as an interactive technique adopted by educators to replicate scenarios students may encounter in the clinical environment [16]. While significant evidence supports the use of experiential learning in student education, further research is needed to compare its' various mechanisms [6,7].

Current literature is unsuccessful in distinguishing which experiential learning tool is more effective [6]. A number of studies have investigated separate forms of experiential learning in parallel, such as utilizing both patient simulation and interprofessional education simultaneously [18-22]. However, prospective research should examine patient simulation independently without the inclusion of interprofessional education or any other mechanisms of experiential learning.

Likewise, existing literature has yet to establish a standard protocol for conducting patient simulation [17]. Full-body mannequins, online case studies, and other technological devices have been used in place of SPs in several studies. [6,12,16,17,21-31] There is a demand for supplemental research to further explore the utilization of SPs and the efficacy of this approach to patient simulation [16].

Several studies investigate the relationship between patient simulation and student education in respect to cost assessments [6,16,32]. Ohtake et al. disclosed their finances while utilizing full-body mannequins in place of standardized patients [23]. Additional information disclosing the costs associated with SPs would allow academia to budget and advocate for their own simulation experiences [16].

While numerous researchers have observed the practice of patient simulation in clinical education, the majority fail to involve physical therapy students [16,31,33,34]. A majority of the literature on patient simulation concerns its use with medical students or other healthcare professionals [16,31,33,34]. However, fewer studies have considered patient simulation in regard to the education of physical therapy students [16,31,33,34].

More evidence is needed to ascertain whether simulation can reinforce all of student education. Several studies have failed to specify what content was taught through simulation [16]. It is important that educators know which areas of their curriculum might benefit from patient simulation. This study will assess the ability of patient simulation to assist in the instruction of diabetic foot care. The findings of this study may be used to determine the efficacy of SPs in patient simulation as well as patient simulation as an experiential learning tool for physical therapy students. Lastly, this study can serve as a cost comparison for physical therapist education programs hoping to conduct simulations with SPs.

A convenience sample of 49 physical therapy students were recruited in the spring of 2022 while enrolled in the second year of their entry-level physical therapy education program at Central Michigan University (CMU). Participation in the simulation was required as part of their curriculum on acute care in their Exam and Diagnosis IV course. Pre- and post-confidence surveys were completed voluntarily in addition to a post-simulation survey. Survey feedback did not influence student placement in their program or course. Informed consent to use survey responses was verbally obtained from all 49 students. Approval from the institutional review board was received. Prior to the simulation experience, students were instructed on how to perform foot screens on individuals with diabetes and educated on regular foot care and disease management. Education was provided in both lab and lecture format.

## Materials and Methods

The study consisted of a mixed methods approach to examine the experience of utilizing a multimodal teaching environment with the use of patient simulation in an acute care setting. Mixed methods included qualitative research surveys and quantitative data analysis based upon the pre and post survey responses to identify any statistically significant changes.

Six standardized patients were commissioned from the Interprofessional Education (IPE) Simulation Center Standardized Patient Pool for the purposes of this study. Prior to the experience, SPs were trained by course instructors on patient case scenarios for a duration of two hours. All patient case scenarios required SPs to depict themselves as an individual with diabetes. Post training, each SP engaged in patient simulation for a number of six hours. All standardized patients received compensation of 25 dollars per hour for both pre-simulation training and patient simulation.

Students worked in groups of three to four pre-determined by course administrators. Each group met with their assigned SP in the CMU IPE simulation center. Students were instructed to collect subjective history, perform a balance assessment, and administer a foot screen. Foot screens involved a skin and sensory assessment and were conducted according to guidelines

set by the Comprehensive Diabetes Lower Extremity Amputation Prevention Program (CDLEAP), an approach to prevent and manage foot disorders for those with diabetes mellitus or other neuropathic conditions [35]. Per CDLEAP protocol, students placed standardized patients in a risk and management category based on examination findings [35]. Students provided SPs with education on regular foot care and disease management to conclude each simulation.

Students completed a pre- and post-confidence survey before and after the simulation to assess any changes in their confidence performing diabetic foot screens. Confidence was measured on a scale of 1 to 4 (not confident to very confident) and reported in individual subscales to appraise various clinical components of diabetic foot screens. Subscales analyzed foot screen components such as student knowledge and skills, patient assessment, exam

interpretation, and patient education. An additional post-simulation survey evaluated the students' perception of the IPE experience. Post-simulation surveys rated student appreciation on a scale of 1 to 4 (not at all to very much). All surveys were taken voluntarily and executed with Microsoft forms on a secure university-based password protected server. Post-confidence and post-simulation surveys were completed after grades had been entered for the acute care module of the student's Exam and Diagnosis IV course.

## Statistical Analysis

Although the study was primarily qualitative, a mixed methods approach was used to highlight data changes from pre- to post-survey responses. Statistical Product and Service Solutions software determined the statistical significance of the pre- and post-survey results based on analysis of variance (Table 1).

		Paired Differences					t	df	Significance	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				One-Sided p	Two-Sided p
					Lower	Upper				
Q1. Knowledge and Skills	Q1Post - Q1Pre	.841	.776	.117	.605	1.077	7.189	43	<.001	<.001
Q2. Patient Education	Q2Post - Q2Pre	1.000	.715	.108	.783	1.217	9.274	43	<.001	<.001
Q3. Assessment	Q3Post - Q3Pre	1.045	.645	.097	.849	1.242	10.746	43	<.001	<.001
Q4. Exam Interpretation	Q4Post - Q4Pre	1.091	.858	.129	.830	1.352	8.436	43	<.001	<.001

**Table 1:** Statistical significance of the pre- and post-confidence survey results based on analysis of variance. *P* values for the paired samples test are listed.

The seven steps of phenomenological research by Paul Colaizzi as cited in Phillips-Pula et al [36] and Finalyson et al [37]. was also utilized by researchers to provide reliable analysis of the data in determining overarching qualitative themes.

## Results

All pre-confidence surveys (N=49) were completed. Forty-four out of the forty-nine (89%) students completed the post-

confidence and post-simulation surveys. The majority of students reported that they felt "somewhat confident" in all subscales of the pre-confidence survey prior to the simulation experience. There was a significant improvement seen in the student confidence observed across all subscales on the post-confidence survey (Table 2.)

		Mean	N	Std. Deviation	Std. Error Mean
Q1. Knowledge and Skills	Q1Pre	2.32	44	.708	.107
	Q1Post	3.16	44	.608	.092
Q2. Patient Education	Q2Pre	2.27	44	.660	.099
	Q2Post	3.27	44	.660	.099
Q3. Assessment	Q3Pre	2.34	44	.608	.092
	Q3Post	3.39	44	.579	.087
Q4. Exam Interpretation	Q4Pre	3.30	44	.668	.101
	Q4 Post	3.30	44	.668	.101

Table 2. Level of student confidence with each clinical component conducted in a diabetic foot screen as dictated on pre- and post-confidence surveys.

Student confidence in exam interpretation improved the most out of all foot screen components whereas student confidence in knowledge and skills demonstrated the least improvement. There was a significant improvement in the average student confidence score reported on the post-confidence survey compared to the average student confidence score reported on the pre-confidence survey pre-simulation (Figure 1.)

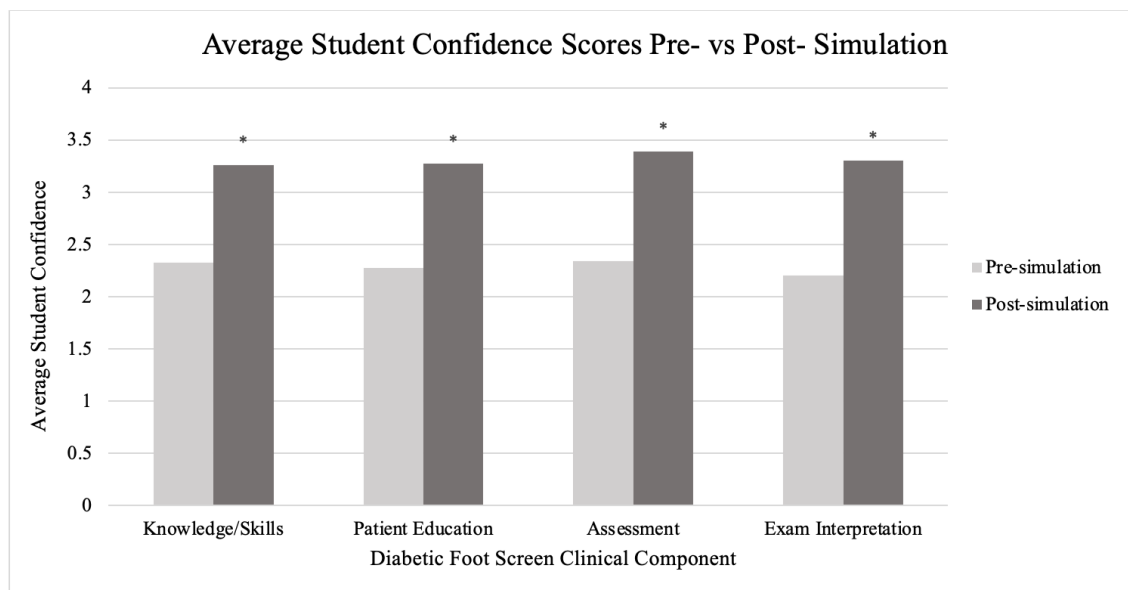


Figure 1. Average student confidence scores reported for each clinical component of a diabetic foot screen on the pre- and post-confidence surveys before and after student participation in patient simulation. There was a significant increase in student confidence reported for each clinical component after the patient simulation was conducted (n=44, \* $p < .001$  for each clinical component pre- vs post-simulation).

Prior to the experience, students rated their confidence in exam interpretation as a 2.20 +/- .668 out of 4 on average which increased to a 3.30 +/- .668 (109%,  $p < .001$ ) after the simulation was finished. Students' confidence in their knowledge and skills increased 84% ( $p < .001$ ) from 2.32 +/- .708 to 3.16 +/- .608 post-simulation. Student confidence improved in both patient assessment (2.34 +/- .608 versus 3.39 +/- .579, pre-confidence versus post-confidence survey,  $p < .001$ ) and patient education (2.27 +/- .660 versus

3.27 +/- .660, pre-confidence versus post-confidence survey,  $p < .001$ ) as well. The percentage of students who felt “very confident” across all subscales increased from zero to 15% ( $n=0$  versus  $n=7$ , pre-simulation versus post-confidence survey) after participating in the experience. The average confidence score reported across all subscales was significantly higher post-simulation (2.22 versus 3.27, pre-confidence versus post-confidence survey).

Findings suggested that the majority of students were satisfied with the experience. Thirty-two out of forty-four participants (72%) indicated that they “very much” agreed (3.68 out of 4, post-simulation survey) that the experience was beneficial to their learning by providing a real-life patient experience. The same percentage (72%) answered that they “very much” agreed (3.68 out of 4, post-simulation survey) that the simulation should be more widely used in physical therapy curriculum. The average student reported that they “agreed” (3.43 out of 4, post-simulation survey) that their experience with a standardized patient improved their ability to complete a diabetic foot screen. Over half of students (63%) recorded that they “very much” agreed (3.45 out of 4, post-simulation survey) the experience increased their confidence in performing diabetic foot assessments.

Nearly all of the participants provided positive feedback about the simulation experience. Several participants expressed that the simulation allowed them to apply the content they were learning in school. One student expressed that the simulation was “more motivating” and that they were able to “be more present” in comparison to participating in lecture. Another student described the simulation as a “practical, low-stakes learning environment.” Most students compared their standardized patient to an actual patient citing “interacting with a real patient” as the most valuable part of the experience. A significant number of students also wrote about how the experience furthered their development as a clinician. “Bedside manner and professionalism” were mentioned as areas of improvement post-simulation as well as gains in “confidence.” Many participants appreciated the opportunity to practice their clinical skills “in real time” saying that the experience replicated future scenarios they would have in a clinical environment. One student wrote “this was the most valuable learning experience I have had this semester... and I wish we did this more often.”

## Discussion & Conclusions

Overall, all participants agreed that the simulation was a valuable addition to their learning. Most students appreciated the opportunity to practice with a SP and noted that the simulation closely replicated future clinical requirements. Improvements were seen in all foot screen components on the post-confidence survey. While the greatest improvements were observed in the students’ confidence to interpret an examination, the simulation was least effective in enhancing student confidence in their knowledge and skills.

The results of this study suggest that patient simulations may assist in the education of physical therapy students on diabetes mellitus and its management as well as improve student confidence in their clinical skills. While current evidence has led to the integration of patient simulation in multiple healthcare programs [16,17,33,34], this study contributes to the literature on its application with physical therapy students. This model can be used to compare the various methods of patient simulation and experiential learning to identify best practice and allocation of student resources. In addition, this study serves as a cost comparison for physical therapy education programs hoping to incorporate patient simulation and standardized patients into their curriculum.

Although its findings provide evidence for further application of patient simulation, this study was limited in several ways. All students received lecture content and instruction on diabetic foot care prior to the experience. Because the simulation was completed as part of a required course, researchers were unable to establish a control group of students who were not educated on the material. Study results may have been implicated by the participant’s concurring education. However, students were provided with pertinent course material before completing their pre-confidence surveys and student confidence improved after the experience despite any education provided beforehand.

Researchers were unable to measure student confidence on a long-term basis. All outcome measures were performed during the school year before students left for their clinical rotations. An additional follow-up assessment could perceive long-term changes in student confidence and examine its influence on student proficiency in a clinical environment. Long-term studies could examine how improving student confidence transfers to performance in the clinical setting.

Other limitations of this study include its small sample size and subjective data collection. Survey responses were subjective in nature and unable to objectively measure student confidence. Subjects were selected from a single class of physical therapy students from one physical therapy education program. Prospective research should incorporate multiple physical therapy education programs to obtain a larger sample size and utilize more objective measures for evaluating student confidence, understanding of course content, or competence in clinical skills.

## Disclosure

**Author Contributions:** Conceptualization, R.K. and J. H.; methodology, R. K. and J. H.; software, R.K.; formal analysis, R. K. and C.C.; resources, A.D.; data curation, R.K., A.D. and C.C.; writing—original draft preparation, A.D.; writing—review and editing, A.D. and R.K.



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**Data Availability Statement:** Data supporting the study results can be provided followed by request sent to the corresponding author's e-mail.

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**Conflicts of Interest:** None.

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