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THE EVALUATION OF DOCTOR OF PHYSICALTHERAPY STUDENTS' CONFIDENCE AND SATISFACTION USING HUMAN PATIENT SIMULATION

Brooke O'Connell
University of Rhode Island, boconnell@my.uri.edu

THE EVALUATION OF DOCTOR OF

PHYSICALTHERAPY STUDENTS' CONFIDENCE

AND SATISFACTION USING HUMAN PATIENT

SIMULATION

BY

BROOKE O'CONNELL

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BROOKE O'CONNELL

APPROVED:

Thesis Committee:

Major Professor Clinton O. Chichester

Sara Rosenbaum

Janice Hulme

Nasser H. Zawia
DEAN OF THE GRADUATE SCHOOL

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Abstract

Doctor of Physical Therapy (DPT) curricula are designed to train physical therapy students to treat patients across a range of treatment needs and settings. However, the ability to provide students with hands on experience in a variety of settings can be limited. Acute care setting experience can be particularly challenging to provide students due to availability issues, legal concerns, and limited clinical opportunities. Human patient simulators; however, are not hindered by the same restrictions. Consequently, simulators provide a valuable resource for students to expand their acute care experience. This study was designed to evaluate the confidence and exposure levels of DPT students following a simulated acute care case administered as part of a practical for an existing cardiopulmonary course. The findings of this study were used to evaluate the potential benefits of a simulated case for students enrolled in this course and make recommendations regarding expansion of simulated cases.

This study was conducted using a blinded one group randomized pre- and post-test design in which 36 students participated. While participation in the practical was required for the course in which students were enrolled, students voluntarily completed consent forms and relevant study materials used to assess their experience. Prior to the practical, students participated in a practice laboratory session in order to gain familiarity with the simulators and practice skills needed for the simulation practical. The class was divided in half; each half of the class attended one of two laboratory sessions and rotated around the three stations present during the session. Six weeks later, students completed pre-*Competency and Confidence Scales*. Ten days

after the pre-*Competency and Confidence Scales* were completed, students participated in the simulation practical. The class of students individually signed up for one of the provided time slots, creating groups of two to three students. Two scenarios were developed to address time concerns and simulator capability, and each group of students only participated in one of the scenarios. However, key aspects of the cases were kept consistent, such as the staging of the simulator and the response by the simulator to the decisions of the students. Following each group's completion of the practical one of two instructors for the course would debrief them on the experience. After the debriefing session, students completed post-*Confidence and Competency Scales* as well as satisfaction surveys.

Information recovered from the *Confidence and Competency Scales* and satisfaction surveys was analyzed statistically and mathematically, using Microsoft Office Excel 2011. The pre- and post-confidence and exposure parameters were analyzed using a paired two-tailed t-test. From this analysis several parameters were determined to demonstrate statistical significance. These parameters encompassed technical and non-technical skills across both categories of confidence and exposure. Individual scores were further evaluated by determining the mathematical difference between pre- and post-confidence parameters as well as pre- and post-exposure parameters. This approach was used to determine the degree of change or lack thereof in individual student scores. From this approach it became clear that while many students' scores improved by one unit on the scale used, several improved three units; indicating that some students had a stronger response to the simulation than others.

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Preface

This thesis has been completed using the Manuscript Format, in partial completion of the requirements for a Master of Science in Pharmacology and Toxicology degree from the College of Pharmacy at the University of Rhode Island. It will be submitted to the Journal of Acute Care Physical Therapy for future publication.

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Chapter 1

"The Evaluation of Doctor of Physical Therapy Students' Confidence and Satisfaction Using Human Patient Simulation"

by

Brooke O'Connell[1]; Clinton O. Chichester[2]; Samantha Brown[3]

is submitted to Journal of Acute Care Physical Therapy

[1] MS Candidate, College of Pharmacy, The University of Rhode Island, Kingston, RI 02881. Email: brookekoconnell@gmail.com

[2] Professor, College of Pharmacy, The University of Rhode Island, Kingston, RI 02881. Email: chichester@uri.edu

[3] Clinical Assistant Professor, Department of Physical Therapy, The University of Rhode Island, Kingston, RI 02881. Email: skbrown@uri.edu

Introduction

Several learning theories support the use of high fidelity manikin-based simulation use in education; for the sake of brevity, this paper will focus on the theory that most directly supports the incorporation of simulation into teaching, Constructivism.[1] Constructivism is a theory composed of the influences of John Dewey, Jean Piaget, and Jerome Brunner.[1] The theory is based in the belief that learners each have a personal understanding of a given topic, and as they learn about that topic their existing framework of understanding will expand to integrate the new information. There are three key principles to Constructivism. First, each person has their own unique experiences and knowledge. Second, learning is a process that occurs when a person's current understanding of a situation or a concept is inadequate. Finally, learning requires interaction within a social context.[2] Students inherently satisfy the first principle by virtue of having lived is this world up to this point. Well-crafted simulated experiences can easily meet the second and third principles of Constructivism. When students are placed in challenging simulated environments they will need to expand their understanding of the situation in order to complete the tasks of the simulation session. Lastly, simulated experiences can easily be designed as group or team activities meeting the social context requirement. Simulated experiences thereby satisfy all three principles of Constructivism.

Constructivism and similar theories are not yet embraced by many traditional educational programs. Many conventional programs follow more historic approaches to the education of students, focusing instead upon a lecture heavy model.[3] Lecture and apprentice centric approaches focus on a student's ability to observe and reproduce information or actions. However, this approach does not address the needs of students to foster the development of decision making capabilities and technical competencies.[4] Further, traditional education of healthcare professionals specifically, commonly relies on two principles that can be detrimental to the education of students. First, that every clinical role model will be effective, skilled, and demonstrate behaviors worthy of replication. Second, the duration of a training period is sufficient to consider the trainee competent in all the skills practiced during that time period.[5] Teaching approaches such as these limit the access of students to develop strong decision making skills and personal competencies. Structured teaching moments are intended to help students prepare for clinical placements; the more realistic the teaching opportunities the more closely they will replicate clinical expectations. Many acute care clinical settings for example are not designed to host classes of physical therapy students in order to provide them with a chance to observe and interact with patients. In addition to capacity limitations, in acute care settings staff are often limited by productivity standards and hospital and insurance policies that limit availability to mentor students. Finally, legal concerns are another potential hindrance. Depending on the policies of a facility or insurance and reimbursements, restrictions might be exist regarding student involvement in the direct care and treatment of patients. Further, laws regulating patient information can restrict student access to even patient charts and clinical costs are also a barrier.

Simulated clinical experiences are not restricted by the challenges mentioned above, and can therefore fill an educational void in many existing programs by providing a hands-on and dynamic learning environment for students. High fidelity human patient simulators are controlled by computer software that offers accurately modeled cardiac and respiratory responses, ensuring valid and consistent patient presentations for students. Further, these simulators can be controlled remotely in real-time enhancing the realism of events.[6] Accurate physiologic modelling can be relied upon to present uncommon cases to students prior to their professional years, giving them the advantage of experience. The advanced capabilities of these simulators allow educators to design challenging and reproducible scenarios for students addressing issues of staffing legal liability, and volumes of students. Finally, while initial outlay of funds to acquire a simulator is significant, the maintenance and supplementary supplies in the long term are less expensive than training and paying standardized patients. All of these considerations make simulators invaluable additions to educational programs, especially considering the goals of physical therapy education and the hands on nature of the profession.

An integral part of any physical therapy practice is the ability to perform clinical skills efficiently, safely, and competently.[7] The challenge in preparing competent and capable physical therapists is to mold students into well-rounded professionals, adept in necessary procedural skills as well as nuanced affective skills. The movements of the human body across different ages and disease states is often best learned through contact with living patients to best understand movements and responses. However, affective skills decision making competencies are best learned through practice and experience. Simulators can provide a soft environment for mimicking professional settings for large groups of students. Simulators also provide a safe platform for acute events such as arrhythmias and respiratory issues, which can be hard to present vividly in the classroom setting, but nevertheless are important situations for students to clearly understand and experience. Simulators provide a platform for the development of affective skills, be it communication within a group or interacting with a patient and family in stressful situations. Affective and communication skills are critical for positive interactions between physical therapists and patients as well as other professionals. While these skills are important they are often only indirectly incorporated into courses and not assessed specifically until clinical placements. Simulated clinical experiences can provide students with an opportunity to practice procedural skills, as well as, challenge them to function in mock acute care clinical settings and in stressful situations where a patient is destabilized. Therefore, simulated practical settings provide students with an opportunity to integrate multiple skill sets simultaneously, under realistic time constraints and under conditions they might not experience at this time in their education otherwise.

Growing evidence is reflecting improved patient outcomes following early physical therapy interventions, this has prompted hospitals to expand early rehabilitation and mobilization efforts.[8] This is a result of increasing research demonstrating that rehabilitative measures in a critical care environment shorten hospital stays and improve functional outcomes.[9] Acute settings require familiarity with specialized equipment and comfort working in such an environment. Patients in an acute care setting are often connected to various lines and tubes, they are also at an increased risk for sudden deteriorations in status. As a patient deteriorates, quick and efficient responses from physical therapists and other healthcare professionals can reduce the risk of detrimental injuries. The increased demand for physical therapists with an interest in working in an acute care setting has produced significant job vacancies; the national vacancy rate for physical therapists in acute care hospitals in 2010 was 10 percent.[10] The lack of physical therapists pursuing these positions is open to speculation; however, a reasonable assumption can be made that students are not pursuing acute care positions because they are not comfortable or familiar with the demands of acute care settings. If true, it would benefit physical therapy students to increase their experience with acute care settings to increase comfort, confidence, and interest in this setting.

This study was designed to evaluate the response of students to a simulated acute patient case, with regards to their confidence and exposure across nineteen parameters. The parameters consisted of technical and non-technical skills including: Evaluative skills such as taking a patient's heart rate; Procedural skills such as moving a patient safely in the acute care environment; and Affective skills such as communicating with the patient and family effectively. A pre- and post-test design allowed for the comparison of students' responses before the simulation practical to those they provided afterwards. A paired t-test analysis of the resulting data determined that several technical and non-technical parameters were significant. In order to better understand the changes in an individual student's scores across both categories of confidence and exposure, the mathematical difference between the pre-and post-scores for each significant parameter were determined. These results allowed for consideration of the potential impact of the simulation on the improvement in scores. Considering these results the effects of the simulation session can be evaluated and recommendations made for the future.

Methods

Participants

Thirty-six first year DPT students enrolled in the course Cardiopulmonary Physical Therapy (PHT 570) were recruited for this study and signed consent forms. A simulation practical was incorporated into the course to enhance the experience of students; participation in the practical was required for the course, but participation in this study was voluntary. Prior to the practical with the simulators students received instruction on the treatment of patients in critical care settings emphasizing impaired cardiac and pulmonary conditions through lecture and laboratory experiences.

Study Design

A one group randomized pre- and post-test quasi-experimental design was implemented in this study. One group was used because this practical was incorporated into a course, as such, a control was not feasible and would have left a portion of the class at a disadvantage. Students were provided a sign-up sheet to pick a time to participate in the practical and therefore randomized themselves. A pre- and post-test design was used since students were responding with their individual confidence and exposure levels. Students were codified on the forms, thereby blinding the researchers. The simulation laboratory and practical took place in the CVS Caremark Advanced Human Patient Simulator Laboratory at the University of Rhode Island (URI) during the Spring 2013 semester.

Simulation Preparation

Seven and a half weeks prior to the simulation practical, two groups of approximately seventeen students each attended a three hour simulation orientation and practice laboratory session. Three stations were established each with a simulated patient. Both course instructors and one graduate assistant were each placed at a station. Students, in groups of six, rotated around each station approximately every 45 minutes. The first station consisted of a patient (iStan, CAE Healthcare, Sarasota, Florida) presenting with normal vital signs, connected to various lines, tubes, and equipment. Students were expected to identify everything connected to the patient and address the significance and concerns associated with each in order to then perform a safe transfer to the edge of the bed. The second station consisted of a patient (HPS, CAE Healthcare, Sarasota, Florida) presenting with abnormal vital signs and electrocardiogram readings. Students were expected to assess the stability of the patient and make recommendations about the safety of treatment. The third station consisted of a patient (ECS, CAE Healthcare, Sarasota, Florida) exemplifying several arrhythmias, some which progressed in severity. Students were encouraged to analyze the rhythm and its progression, as well as, examine heart sounds. While each simulator used had different features, they all shared dynamic physiology (such as palpable pulse points and auscultatory heart and lung sounds) and articulated limbs. Each simulator was accompanied by embedded software which allowed for almost instantaneous remote control of physiologic functions from control stations. These measures allow for real time responses by the simulators to the actions and interventions of students. Students continued to attend lectures and participate in the cardiopulmonary class through the end of the course and semester, when 10 days prior to the simulation practical, students completed the pre-*Confidence and Competency Scale*.

Simulation Assessment

Two different assessment forms were used during this study, the *Confidence and Competency Scale* and the satisfaction survey. The *Confidence and Competency Scale* was developed by URI faculty member, Dr. Janice Hulme. The survey was designed to assess and be tailored to different courses throughout the DPT curriculum. The specific parameters assessed by the *Confidence and Competency Scale* were placed into three categories. The Evaluative Procedures category (E#) consisted of technical skills such as taking a patient's blood pressure or identifying lines and tubes attached to the patient. The Procedures & Process Skills in Acute Settings (P#) category consisted of technical skills specific to acute care environments such as the ability to safely perform patient transfers. The Affective Skills category (A#) consisted of nontechnical skills such as discussing treatments with the patient and communicating with fellow healthcare professionals. This scale has yet to be validated and or tested for reliability, however, for the purposes of this study it was well suited to assess this practical experience. The evaluation parameters were kept consistent between pre- and post-*Confidence and Competency Scales.* The satisfaction survey was added to the post-*Confidence and Competency Scale,* the questions were similar to those asked of other students who participated in courses incorporating simulation at URI.

Simulation Development

The two patient cases were developed to meet scenario objectives and test confidence and exposure parameters across the categorized skills of the *Confidence and Competency Scale.* Two cases were designed to accommodate the number of students and address the availability and features of simulators. Two simulators with different levels of fidelity were used; one had more enhanced technical abilities such as the ability to transfer the mannequin without concern for an umbilical cable connecting the mannequin to a control unit. Despite these differences, the key aspects of the cases remained consistent. Both patients experienced a change in status following mobilization efforts by students. Both patients were presented to students 24 hours after surgical procedures and indicated the presence of minor pain at the surgical site. Finally, both patients were staged identically for the sake of consistency.

The first case, Case A, featured a simulated patient of 72 years of age. At the time of the scenario, the patient was alert, cooperative, and stable. The simulated patient presented as conscious and alert, with a right radial intravenous line, nasal cannula, oxygen saturation monitor on the left index finger, electrocardiographic (ECG) leads, a PCA in the right hand, and a foley catheter. A bedside monitor provided dynamic vital signs (blood pressure, heart rate, Oxygen saturation, and ECG tracings).

The second case, Case B, featured a simulated patient of 75 years of age. At the time of the scenario the patient was alert, cooperative and stable. The simulated patient presented as conscious and alert, with a nasal cannula, oxygen saturation monitor on the left index finger, electrocardiographic (ECG) leads, a PCA in the right hand, and a foley catheter. A bedside monitor provided dynamic vital signs (blood pressure, heart rate, Oxygen saturation, and ECG tracings).

Simulation Scenario Objectives

The simulation practical incorporated into the course was designed to reduce the anxiety of students by minimizing its weight towards the final grade and by utilizing a group design. The performance of students had minimal impact on their grades in the course, as this practical accounted for 2 percent of the final grade. Objectives of the simulation experience were for students to: (1) gain familiarity with an acute care setting; (2) effectively communicate with a responsive simulated patient (voiced by an actor using a radio within the mannequin) and as a team; (3) identify monitoring equipment and lines connected to the patient; (4) assess the patient's readiness for physical therapy interventions; (5) interpret physiologic responses to student interventions; (6) demonstrate safe patient mobilization during the session; (7) identify and react appropriately to patient status changes; (8) make recommendations for care following the session.

The *Confidence and Competency Scale* was tailored to quantify these objectives. The skills selected were chosen to reflect the significance of technical and non-technical skills. Extensive research has confirmed the practice of technical skills in improving patient outcomes.[10] More recently, research has indicated that procedural and affective skills are equally important in ensuring patient safety and improving patient outcomes.[11]

Simulation Deployment

On the day of the simulation practical, students arrived in pre-scheduled groups of two (n=1) or three (n=11), and met with one of the assisting graduate students to review case information. Students were prompted to meet with the patient after reviewing the cart. A family member was present as played by an assisting graduate student. The voice of the patient (provided by a graduate student hidden from view), a course instructor, and a technician were present in the control room observing the performance and managing the progression of the case, while making notes for each debrief. During the course of the scenario students were expected to complete the tasks outlined in the *Confidence and Competency Scale* as part of a successful completion of the practical. During the completion of each case students were expected to respond appropriately to a change in patient status. Each group spent at most 20 minutes completing the session. Immediately after the simulation practical instructors debriefed students as a group, the discussions were informal and intended as reflection and learning opportunities. Following the debriefing session students completed the post-*Confidence and Competency Scale* and the satisfaction survey.

Outcome Measures

The *Confidence and Competency Scale* and satisfaction surveys were administered to assess the simulation practical. The *Confidence and Competency Scale* consisted of nineteen parameters under the categories of Evaluation Procedures, Procedures and Process Skills in Acute Settings, and Affective Skills. The scores for the "Exposure" parameters ranged from 0, which reflected "no exposure," to 4, which reflected "clinical, classroom, and lab" exposure. The scores for the "Competency" parameters ranged from 0, which reflected "no confidence," to 3, which reflected “competent, no supervision/assistance.” A full explanation of each score can be found in Table 1. (The questions administered to assess satisfaction were only administered after the simulation experience.) Seven questions inquired about the simulation as an educational tool, and three questions related to an interest in further simulation experiences.

Analysis

Responses to the *Confidence and Competency Scale* were scored using the scale present in Table 1. The responses were assessed using a two tailed paired t-test, significance was set at $p<.05$ (Table 2). A two tailed paired t-test was implemented to account for decreased as well as increased scores (Table 2). Further analysis of the pre- and post-*Confidence and Competency Scale* responses was performed by taking the mathematical difference between the pre- and post- values for each statistically significant confidence and exposure parameter (Tables 3 and 4).

The satisfaction of students was assessed through the administration of a satisfaction survey included at the end of the post-*Confidence and Competency Scale* (Table 5). A satisfaction survey had also been administered to second year DPT students as part of a pharmacology course (Table 6). As part of this pharmacology course students participated in three simulation demonstrations. Three questions were the same and administered to both first and second year students as part of a these two courses (table 7). For each table, the grey shaded areas denote a 50 percent or higher response from the population. All statistical analyses were performed using Microsoft Office 2011 Excel software.

Results

Effects of Simulation Experience on Student Confidence

Following the completion of the simulation practical, responses from the *Competency and Confidence Scale* were collected and analyzed. The statistical analysis of the findings revealed some of the tested parameters demonstrated statistical significance. Students' confidence and exposure levels improved significantly across nine and seven parameters, respectively (Table 2). Two exposure, P1 and P2, and eight competency, E4, E7, E8, P1, P2, A2, A3, and A4 parameters demonstrated high levels of certainty exceeding the necessary threshold 'p-value' of 0.05 by a minimum of ten-fold (see Tables 3 and 4). Further, several parameters, E7, E8, P1, P2, A2, and A3, demonstrated significance across both exposure and competency categories; the consistency across both categories demonstrates greater reliability in the relevance of these parameters.

The statistically significant parameters mentioned previously, were examined further by taking the mathematical difference between the pre- and post-*Confidence and Competency Scales* for each parameter (Table 3 and 4). While most students' responses for competency and especially exposure did not change following the simulation practical, a small number of student responses demonstrated pronounced increases following the simulated practical. Across the competency parameters (see Table 4), the increase in scores that improved ranged from 23.3 to 62.5 percent. The parameter with the highest percentage of student improvement was the competency parameter E8, 'The identification of ICU equipment', with fifteen students' responses increasing by 1 and five students' responses increasing by 2. The parameter with the lowest percentage of student improvement was the competency parameter P3b, ‘Ability to assess the bed mobility of the patient’, with six students’ responses increasing by 1 and one students’ response increasing by 2. However, for parameter P3b (Ability to perform: bed mobility), twenty-three of thirty-six student responses did not change following the practical.

Across the exposure parameters (see Table 3), the responses from students were more consistent than the competency parameters; the increase in post scores compared to post scores ranged from 17.6 to 38.2 percent. The parameter with the highest percentage of student improvement was the exposure parameter P1, ‘Ability to safely determine appropriateness of treatment,” with eleven students’ responses increasing by 2 and two students’ responses increasing by 1. The parameter with the lowest percentage of student improvement was the exposure parameter E3, ‘Heart rate (assessment),’ with four students’ responses increasing by 2 and two students’ responses increasing by 1. However, for that parameter, E3, twenty-seven students’ responses did not change following the simulation. It should be noted that across both the competency and exposure parameters many student responses did not change following the practical and no more than four student responses decreased across any single parameter.

Student Satisfaction Following Participation in the Laboratory Session and Practical Simulation Practical

In addition to the responses of students about their confidence and exposure, students responded about their satisfaction with the simulation practical. The responses of students to simulation were generally positive. Of the responses, 82.9 to 88.6 percent of the population “agreed” or “strongly agreed” with the first five survey questions (Table 5). Of these five survey questions, three related to the experience of learning using simulators and two related to the comparison of learning with simulators to more traditional methods. The final question asked if students would be interested in taking an “interactive patient simulation” elective, 68.6 percent of students responded “yes” (Table 5). In addition to survey questions, students were provided with the opportunity to write comments. Only two students wrote comments, requesting clarification. Most students used the debriefing session instead to convey comments to the course instructors. Comments included the challenge of responding to changes in the simulator under realistic time conditions. Overall, student responses to the opportunity were positive.

<u>Student Satisfaction Following Participation in a Pharmacology Course</u>

Second year student satisfaction responses following three simulation demonstrations incorporated into their pharmacology course were similar to satisfaction responses from first year students after the simulation practical. Of the scaled survey questions, at least 57.1 percent of responding students “agreed” or “strongly agreed” with five of the six questions (see Table 6); the remaining students responded neutrally or “disagreed” with the statements. The first four survey questions related to cardiac and pulmonary physiology and drug responses; the final two questions to patient care and safety. The seventh question related to increased confidence with patient interaction and resulted in 35.7 percent of students “agreeing” or “strongly agreeing” with the statement. Students were given the opportunity to write comments and nineteen of twenty-nine did. One wrote “Great simulation … very valuable and interactive.” However, the majority of students noted that the experience would have been more beneficial if the focus of simulations had been the pharmacological implications specifically relevant to physical therapy practice as opposed to generalized drug actions. Students with a basic understanding of the pharmacological effects of such drugs will be better prepared practitioners. This sentiment was highlighted by the comment, “For our purposes (as physical therapy students) emphasis should be placed less on drug choices and recommendation, and more on physical therapy interventions and drugs.”

Combined Student Satisfaction across Two Simulation Experiences Incorporated into the Cardiopulmonary and Pharmacology Courses

Both the surveys provided to first year and second year DPT students had three survey questions in common (see Table 7). The first survey question asked if students remained more engaged during the simulation labs compared to lecture-based classes. Across both groups, 86.3 percent of the population “agreed” or “strongly agreed” with the first survey question. The second survey question asked, if students would be interested in more simulation labs in their professional curriculum, across both groups 82.8 percent replied, “Yes.” The final survey question asked, if students would be interested in an interactive “patient simulation” elective course, across both groups 66.7 percent replied, “Yes.”

Discussion

The statistical results of this study demonstrate improvement across many design parameters. Further, the results indicate this study also met and exceeded many of its design objectives. Across nineteen study parameters, nine demonstrated statistical significance under the confidence category and seven demonstrated statistical significance under the exposure category. Of the nine significant confidence parameters, all but two were emphasized directly in either the laboratory session, simulation practical, or both. Further, of the significant exposure parameters, all but two were emphasized directly in either the laboratory session, simulation practical, or both as well. These results provide confidence that the *Confidence and Competency Scale* met the learning objectives of this study. These results also demonstrate confirmation that six of the eight design objectives outlined in the methods section were met, with the exception of Objectives 2 and 8. However, the *Confidence and Competency Scale* was not tailored to assess Objectives 2 and 8. The *Confidence and Competency Scale* was designed prior to the development of this study and constructed to have broad applications, therefore the specifics of addressing Objective 2 (to effectively communicate with a responsive simulated patient (voiced by an actor using a radio within the mannequin) were not previously considered.). Objective 8 (to make recommendations for care following the session) was a significant component of successful completion of the practical, but given that each group's recommendations would be specific to their completion of the practical correlating all these recommendations would be challenging. These findings reflect the value and significance of this study to exploring human patient simulation in the area of physical therapy education.

In addition to the statistical results, the mathematical differences, between several students' scores before and after the simulation practical, further support the accomplishment of design objectives. Twenty-eight student responses increased by two points and one student's score increased by three points on the scoring scale under the confidence category. Of all the significant parameters, four in particular demonstrated pronounced improvement across the study population. Regarding the parameter "identification of ICU equipment," five students' responses improved by 2 points and fifteen student's responses improved by 1 point. This improvement in student responses supports the accomplishment of design Objective 3. This increase in student confidence is significant because is supports physical therapy student exposure to ICU equipment as required during their education. DPT programs are required to produce professionals prepared and proficient in practicing in a wide range of healthcare settings. In order to do that, often students need exposure. Three additional parameters demonstrated similar gains in improvement; these parameters were "ability to make appropriate adjustments to patient response," "interact with other healthcare professionals," and "identification of lines and tubes." These improvements are important because all of three skills are critical for physical therapist to perform in clinical settings. These skills were included for evaluation due to their significance to effectively working in an acute care setting using both technical and non-technical skills. Most of the significant parameters under the exposure category demonstrated the increases anticipated for almost all the parameters; indicating the expected increase in experience with each parameter. These findings corroborate the assertion that the simulation practical was beneficial for students, improving their confidence with these skills and increasing their exposure.

Additionally, these findings are in line with and expand upon research conducted by Ohtake and associates[12], Silberman and associates[13], and Henneman and associate[14]. This study examined nineteen confidence parameters compared to the study conducted by Ohtake and associates[12], which examined nine parameters. The evaluation of more parameters lends itself to the potential for increased clarity in the data recovered. Further, this study also included student exposure, which the Ohtake study had not. Inquiring as to the source of students' experience with each parameter helps to clarify their familiarity with each parameter. Additionally, this study expanded on principles of the research conducted by Silberman and associates.[13] This study implemented a structured evaluation form, the *Confidence and Competency Scale*, as opposed to four open ended questions as in the previously mentioned study. This study also gave two participating DPT students of each group the opportunity to fill the role of physical therapists during the simulated practical with the final member serving as a physical therapist assistant. In the study conducted by Silberman and associate within each group of four students, each student played a different role (with only one student having the opportunity to play a physical therapist).[13] Finally, this study was designed to quantify the confidence and satisfaction of students as opposed to simply conducting a case study; Henneman and associate had incorporated three simulation sessions to an acute care course for nursing students and only administered a six question satisfaction survey to assess their reactions.[14]

The satisfaction survey responses from students also corroborated the achievement of design objectives. The first survey item related to an improved understanding of physiologic responses, at least 85.7 percent of students “Agreed” or “Strongly agreed” with the satisfaction statement (see Table 5). The high percentage of student agreement with this statement indicate that Objective 4 of the study design, “interpret physiologic responses to student interventions” was met. In order to safely and effectively treat a patient, students need to respond appropriately to changes in patient status. The second survey item related to improved basic physical assessment skills, again 85.7 percent of students “Agreed” or “Strongly agreed” with the satisfaction statement (see Table 5). This item substantiates the fulfillment of Objective 5 of this study, “assess the patient’s readiness for physical therapy interventions.” One of the essential responsibilities of a physical therapist, particularly in the acute and critical care settings, is the ability to assess patient readiness and appropriateness of treatment. The third survey item related to improved understanding of the significance of lines and tubes, 82.9 percent of students “Agreed” or “Strongly agreed” with the satisfaction statement (see Table 5). The high percentage of student agreement on item three support that Objective 3 of the study design, “identify monitoring equipment and lines connected to the patient” was accomplished. In addition to the responses recovered from the satisfaction surveys, many students provided positive verbal feedback to instructors during the debriefing sessions about the benefits of the practical. All of the assessed skills mentioned previously were practiced in the simulation laboratory session offered earlier in the semester and part of successful completion of the simulation practical. The skills selected were incorporated into this study due to their importance to physical therapy practice in general and, more specifically, for their significance to acute care settings.[15]

The results from this study's satisfaction survey correlate with those from second year DPT students after participation in three simulation demonstrations. Following the simulation demonstrations 57.1 percent of second year students "Agreed" or "Strongly agreed" with the first six survey items related to cardiopulmonary physiology, drug response, and patient care and safety (see Table 6). Three satisfaction questions were submitted to both groups, first and second year DPT students. Of these three questions, the first related to the use of simulation as a learning tool and the remaining two related to an interest in increased simulation experiences (see Table 7). At least 82.8 percent of both groups combined "Agreed," or "Strongly agreed," with the first question and also replied "yes" to the second question administered to both groups. Finally, 66.7 percent of both groups replied "yes" to the final question, "I would consider taking an interactive "patient simulation" elective/course." The similarity in satisfaction between the two groups of students supports the adoption of simulation in DPT curriculum at URI.

The satisfaction survey responses recovered from DPT students enrolled at URI are consistent with other studies into high-fidelity simulation use in teaching critical care concepts. Shoemaker and associates exposed DPT students to a critical care simulation session to gauge their response to the use of a simulated ICU case; DPT students regarded the laboratory session positively and commented that the experience increased their confidence with critical care settings.[16] Similar research conducted by Mould and associates[17] evaluated a series of critical care simulations presented to undergraduate nursing students; responses from students regarding their confidence levels were positive. These publications are two of many studies conducted into the response of healthcare students to simulated critical care settings. In addition to the improved confidence and enhanced exposure to the acute setting, these responses indicate students are receptive to simulated healthcare experiences as a teaching tool. Motivation is a key component of teaching; without a desire to learn, sustaining attention and interest is difficult.[1]

Physical therapy education is designed to teach students the skills, knowledge, and behaviors needed to ensure sound clinical decision making, resulting in safe and effective clinical practice.[12] Current physical therapy curricula rely upon academic and clinical experiences to teach students; however, there are limitations to both. While lectures and traditional laboratory sessions are methods instructors use to teach principles and allow for the practice of techniques, they are limited in preparing students for multi-dimensional nature of professional settings. Lectures do not provide opportunities for students to develop competencies and practice skills. Laboratory sessions offer the opportunity for hands on experiences that lectures cannot; however, laboratory sessions are often designed to target specific groups of skills. Clinical experiences expose students to real-life settings and provide insights into professional practice. Clinical exposure provides students with an opportunity to implement what they have learned in the classroom and to gain familiarity with the requirements of a professional setting. In many instances though, clinical experiences are limited by the availability of competent mentors as well as concerns regarding patient privacy. The challenge becomes to find acceptable means of supplementing the learning of students. The simulated practical provides students a chance to manage a patient in a simulated acute care setting; thereby incorporating a mock clinical experience into an academic environment. This study demonstrates improvements in student confidence and exposure across both technical and nontechnical parameters. Therefore, the findings of this study, in conjunction with current research, should be strongly considered when deciding whether or not to include simulation as a means to supplement the acute care experiences of DPT students.

As of 2010, the national vacancy rate for physical therapists in acute care hospitals was 10 percent across acute care hospitals; suggesting a need is not being met.[10] While jobs openings exist for physical therapists in pursuing acute care positions, the source of these vacancies is open to speculation. The availability of positions could be due a high turnover rate of physical therapists in these positions or individuals lacking the skills to excel in these situations. It is also possible that the vacancies are a result of physical therapists seeking employment outside of acute care environments. The question becomes why these vacancies exist, whether it is a lack of comfort with the demands of these positions or a deficiency of competency and familiarity with the specifics of these positions. As medical advances improve and people continue to live longer, the number of patients undergoing treatment and hospitalizations will increase.[18] It was been well established that early mobility in ICU and acute settings have a profoundly positive effect on the cardiovascular and pulmonary systems, reducing length of stay and improving patient outcomes.[20] Therefore, as the population lives to more advanced ages, the need for physical therapists in ICU and acute care settings will continue to rise.[21]

Acute care settings require familiarity with disease states, as well as, the equipment needed to support them. Patients in acute care settings can decompensate quickly, and therefore multiple pieces of equipment are often present to assist in their care. Increased exposure to these types of settings will provide students an opportunity to gain fluency with acute changes in a patient's status, the ability to respond quickly and efficiently to the needs of a patient, and to interact with other team members to address those needs when necessary. Opportunities such as these are limited in clinical settings for various reasons. Simulation provides an opportunity for basic understanding of the equipment needed to support acutely ill patients and allows students during clinical placement more time to focus on the needs of the patient without distraction from the environment. In addition to a basic understanding of the equipment, simulation provides students the freedom to practice moving lines and tubes connected to the patient as well as navigating a patient's bedside without risk of harm. These skills can come easily with practice. However, such environments are not often available in academic settings and clinical opportunities can be limited. Therefore, use of simulation in DPT education enhances student preparedness for clinical and work experience in the acute care setting with increased exposure and mock clinical environments.

A mock acute care setting provides a means for students to practice working within acute care situations under controlled circumstances. Human patient simulators are capable of consistently presenting physiologically accurate acute disease states. The simulators are controlled by advanced computer programs that model the responses that would be expected from human patients. In addition to the confidence provided by the programming of the simulators in the experience of students, a controlled environment allows them to treat a "patient" without risk of harm.[1] Reducing the potential anxiety of students to potentially harming a patient or performing poorly in an unfamiliar setting can improve their comfort with the material.[22] It is also possible that with increased familiarity of the environment and procedures in acute and intensive care settings, students will become more interested and better qualified to pursue employment in these environments. Increased exposure enhanced the curiosity of medical students to learn more about vascular surgery following an endovascular simulation course.[22] Similarly, physical therapy students may also respond positively to low-stress, controlled simulations focused on acute and critical care practice, thus helping to meet a growing need in healthcare. Nevertheless, simulation serves as a tool to enhance the education of students and assists in producing more competent professionals, a common goal across DPT programs.

While simulation sessions are a significant asset to a DPT program and research has documented numerous benefits for students, the substantial financial investments and personnel needed to provide simulated experiences cannot be over looked. It is important to consider the intended goals of a learning experience and carefully consider the appropriateness of simulation as a teaching medium regarding the intended educational goals of the program. Research conducted by Lapkin and associates compared knowledge acquisition, clinical decision making, and student satisfaction using both medium- and high-fidelity simulation with second and third year nursing students.[20] While no difference was observed in knowledge acquisition or satisfaction, clinical reasoning skills improved two fold for high-fidelity simulation compared to medium simulation.[20] However, this benefit needs to be weighed against the cost. The use of high-fidelity simulation in the Lapkin study was five times more expensive than the medium-fidelity simulation.[20] The cost of simulators used in this study ranged from $33,500 to $68,000 according to our regional sales representative. A wireless self-contained mannequin, at a cost of $42,500, would also be well suited to the needs of a physical therapy program, as it would provide greater mobility than one requiring an umbilical cable connecting it a control unit. Not included above are the costs associated with creating an environment to enhance the experience of students, such as hospital beds and associated equipment.

The cost of developing a simulation laboratory can vary widely depending upon available space and funding. The simulation program at the College of Pharmacy at URI began in a classroom with hospital beds donated by a local hospital and expanded to a seven room hospital suite setting. The program, over several years, has also expanded beyond the College of Pharmacy to enhance the learning of undergraduate nursing students and DPT students. Exploring opportunities for collaboration with other programs such as the partnership between the DPT program and the College of Pharmacy at URI can offer a means to provide students with valuable simulation experiences without substantial financial investments. Joint funding efforts between departments or institutions could also reduce the financial burden to any one entity. Finally, it might be possible to seek an arrangement with an existing hospital or university simulation center. Many expansive programs in larger institutions, often provide simulation services such as refreshers and ACLS or BLS practice opportunities, Washington State University's College of Pharmacy is one example.[23] Based on the findings of this study, there is merit to enhancing the student experience with simulations and available avenues should be explored.

While scores demonstrated an increase in student confidence and satisfaction following the practice laboratory sessions and the simulation practical, the comments made by students during the debriefing sessions maybe the most significant regarding lasting benefits for students. Students in this study responded positively about the opportunity to practice skills they learned in PHT 570, Cardiopulmonary Physical Therapy, but more so, of integrating skills from previous courses. The design of this practical integrated skills and concepts across various courses in the DPT program. The practical gave students an opportunity to synthesize skills such as reviewing charts, implementing evidence based treatments, communicating effectively, and practicing proper body mechanics, as well as, an opportunity to demonstrate professional behaviors and core values as defined by the APTA This study is just one example of the depth and breadth with which these experiences can be designed.

The realism of simulations also lends itself well to the development and implementation of interdisciplinary experiences. Inter-professional education is crucial to ready healthcare professionals for the rigors of collaborative healthcare delivery and improved patient outcomes.[24] Interdisciplinary opportunities further enhance the learning of students by providing a means of practicing a key facet of clinical care prior to graduation. One example of such findings are from a study conducted by Buczacki and associates, in which inter-professional communication skills training as part of undergraduate medical education improved students' confidence and effectiveness in communicating with allied health professionals.[25] Research recently conducted by Smithburger and associates[26] provides an example of the use of human patient simulation to advance interprofessional education. In their study they challenged medical, pharmacy, nursing, physician's assistant, and social work students to work in small groups to complete complex simulation scenarios and found that student teamwork and communication improved.[26] Further research should be pursued to confirm these findings across institutions and programs, but the findings from Smithburger and associates[26] is promising.

This study as well as complementary research into human patient simulation provides insight into the benefits of simulation for students, as well as the enormous potential that exists for expanding existing programs and augmenting the applications of simulation programs. While this study demonstrated the benefits for a specific group of students, further research is needed in order to corroborate the findings across other classes of students and additional institutions For example, this study had a limited sample size and applied a simulation session to a single class; in order to speak more broadly about the potential impact of simulations for DPT students in general a larger population should be examined and access more broad skill sets. Additionally, a follow-up assessment should be conducted to determine if there were any lasting benefits of the simulation sessions on students' abilities. Despite these limitations, the responses from students, in this study, about their experience in the simulation practical were positive, and implied that the greatest benefit of the practical was not quantified by the *Confidence and Competency*. Many of the DPT students in this study were grateful for the challenge of treating a simulated patient in mock hospital setting because it gave them an opportunity to synthesize skills that they had not had before.

Considering this result, as well as the findings of this study and others, simulators should be strongly considered for incorporation into a range of health care related educational programs.

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Tables

Table 1–*Confidence and Competency Scale* Ranking System

Exposure	0	No exposure
	1	Classroom only
	2	Classroom and lab
	3	Clinical only
	4	Clinical, classroom, and lab
Competency	0	No confidence
	1	Minimal competency
	2	Competent, guidance only
	3	Competent, no supervision/assistance

Table 2– Statistical Analysis of *Confidence and Competency Scale* Data

	Parameters	Exposure		Competency	
		n	p-value	n	p-value
Evaluation Procedures:	1. Blood pressure	34	—	33	—
	2. Respiratory rate^	34	.0114	33	—
	3. Heart rate	34	—	32	—
	4. Lung sounds*	34	—	33	.0048
	5. Capillary refill	34	—	32	—
	6. Values of SpO2	34	—	33	—
	7. Identification of lines and tubes*,^	34	.0101	33	.004
	8. Identification of ICU equipment*,^	34	.01	32	2E-5
	9. Read and interpret vital signs	34	—	33	—
Procedures & Process Skills in Acute Settings:	1. Ability to safely determine appropriateness of treatment *,^	34	.002	32	2E-5
	2. Ability to make appropriate adjustments to patient response*,^	34	.001	32	4E-5
	3.a Ability to perform: ROM	34	—	31	—
	3.b Ability to perform: bed mobility *	34	—	32	.0435
	3.c Ability to perform: transfers	34	—	32	—
	3. Use of proper body mechanics	34	—	32	—
Affective Skills:	1. Give instructions to patients	31	—	30	—
	2. Discuss PT management with patient *,^	31	.0252	30	.002
	3. Interact with other health professionals and team members*,^	31	.0082	30	4E-5
	4. Request more or less help or supervision*	30	—	32	.0055

Table 3–Mathematical Difference in Student's pre- and post-Exposure Scores

Exposure Parameters	**Difference in post- and pre-Scores***						
	4	**3**	**2**	**1**	**0**	**-1**	**-2**
E2–Respiratory rate	0	0	8	1	24	0	1
E3–Heart rate	0	0	4	2	27	0	1
E6–Values of SpO2	0	1	5	3	23	0	2
E7–ID of lines and tubes	0	0	5	5	22	2	0
E8–ID of ICU equip.	0	0	5	5	21	2	0
P1–Appropriateness of treatment	0	0	11	2	19	1	1
P2–Adjustments to patient	0	1	9	3	19	2	0
A2–Discuss PT management	0	1	2	6	20	2	0
A3–Interact with professionals	1	3	5	4	14	3	1

Table 4–Mathematical Difference in Students' pre- and post-Competency Scores

Competency Parameters	Difference in post- and pre-Scores*					
	3	**2**	**1**	**0**	**-1**	**-2**
E4–Lung sounds	0	2	12	16	3	0
E6–Values of SpO2	1	0	11	17	3	1
E7–ID of lines and tubes	0	4	14	12	3	0
E8–ID of ICU equip.	0	5	15	10	2	0
E9–Read vital signs	0	1	9	21	1	1
P1–Appropriateness of treatment	0	2	16	13	1	0
P2–Adjustments to patient	0	1	18	11	2	0
P3b–Perform: bed mobility	0	1	7	21	3	0
P4–Proper body mechanics	0	1	6	23	2	0
A2–Discuss PT management	0	4	9	17	0	0
A3–Interact with professionals	0	4	11	15	0	0
A4–Request help	0	3	5	22	0	0

Table 5– Satisfaction Survey Questions Administered after the Simulation Practical

Survey Questions	Student Responses				
	5- Strongly Agree	4- Agree	3- Neutral	2- Disagree	1- Strongly Disagree
1.) Simulation lab improved my understanding of physiologic responses.	12	18	4	1	0
2.) Simulation lab improved my basic physical assessment skills.	12	18	5	0	0
3.) Simulation lab improved my understanding of indications and precautions for lines and tubes.	12	17	6	0	0
5.) The content of the simulation lab reinforced other coursework.	16	15	4	0	0
6.) Working with this simulation case has enhanced my educational experience.	17	13	5	0	0
	Yes	**No**			
2.) I would consider taking an interactive "patient simulation" elective.	24	11			

Table 6–Satisfaction Survey Questions Administered after the Pharmacology Course

Survey Questions	Student Responses				
	5- Strongly Agree	4- Agree	3- Neutral	2- Disagree	1- Strongly Disagree
1.) Simulation lab improved my understanding of pulmonary physiology.	7	18	2	1	0
2.) Simulation lab improved my understanding of cardiac pathology/pathophysiology.	8	16	3	1	0
3.) Simulation lab improved my understanding of drug response.	14	10	3	1	0
5.) Simulation lab enhanced my confidence with patient interaction.	7	13	6	2	0
6.) Simulation lab improved my understanding of routinely ordered lab tests.	4	6	11	7	0
7.) Patient simulation lab helped me understand "real-life" patient outcomes.	3	13	8	4	0
	Yes	**Maybe**	**No**		
1.) Practicing patient counseling skills with simulated "patients/families" would be helpful for difficult cases including end of life care.	24	4	0		

Table 7–Satisfaction Survey Questions Administered to Students Who Participated in the Simulation Practical and the Pharmacology Course

Survey Questions	Student Responses				
	5-Strongly Agree	4-Agree	3-Neutral	2-Disagree	1-Strongly Disagree
When compared to lecture-based classes, I remain more engaged during simulation labs.	39	24	9	1	0
	Yes	Maybe	No		
I would like more simulation labs in my professional curriculum.	53	4	7		
I would consider taking an interactive "patient simulation" elective/course.	42	4	17		

Appendices

Pre-Simulation Competency and Confidence Scale (Page 1)

University of Rhode Island Program in Physical Therapy
PHT 570 CARDIOPULMONARY PHYSICAL THERAPY

STUDENT SELF-ASSESSMENT OF COMPETENCY/CONFIDENCE *PRE SIM LAB*

Date Completed: ________________ Code: ______________
(CODE = initial of mother's 1st name, last two digits of SS#, initial of father's 1st name) i.e.: G10E

Key for Rating Scales

Rating your exposure:

Using the following scale, indicate for each item listed below whether you have been exposed to the item during the classroom, lab, or clinical situations.

4 = Clinical, classroom, and lab
3 = Clinical only
2 = Classroom and lab
1 = Classroom only
0 = No exposure

Rating your competency:

Competency means to consistently perform the activity accurately, skillfully, and in the appropriate time and place. Under the competency column indicate how competent you feel in each using the following scale:

4 = Competent, no supervision/assistance
3 = Competent, guidance only
2 = Minimal competence
1 = No confidence

	Exposure					Competency			
	0	**1**	**2**	**3**	**4**	**0**	**1**	**2**	**3**
Didactic Information									
1. Gathering relevant history from case									
Evaluation Procedures									
1. Blood Pressure									
2. Respiratory Rate									
3. Heart Rate									
4. Lung Sounds									
5. Capillary refill									
6. Values for SaO2									
7. Identification of lines and tubes									
8. Identification of equipment in ICU									
9. Read and interpret vital signs									
Procedures & Process Skills in the Acute Setting									
1. Ability to safely determine appropriateness of treatment									
2. Ability to make appropriate adjustments to patient response									
3. Ability to safely perform:									
a. ROM									
b. Bed mobility									
c. Transfers									
4. Use of proper body mechanics									
Documentation									
1. Writing SOAP Notes									

Pre-Simulation Competency and Confidence Scale (Page 2)

Code: ___________ *Page 2*

Affective Skills									
I am confident in my ability to competently...									
1. Give instructions to patients									
2. Discuss illness with patients									
3. Communicate with patients' family									
4. Discuss PT management with patient									
5. Communicate effectively with physicians									
6. Interact with other health professionals									
7. Request more or less help or supervision									

Post-Simulation Confidence and Competency Scale/Satisfaction Survey (Page 1)

University of Rhode Island Program in Physical Therapy
PHT 570 CARDIOPULMONARY PHYSICAL THERAPY

STUDENT SELF-ASSESSMENT OF COMPETENCY/CONFIDENCE *POST SIM LAB*

Date Completed: ________________ Name: ________________

Key for Rating Scales

Rating your exposure:

Using the following scale, indicate for each item listed below whether you have been exposed to the item during the classroom, lab, or clinical situations.

4 = Clinical, classroom, and lab
3 = Clinical only
2 = Classroom and lab
1 = Classroom only
0 = No exposure

Rating your competency:

Competency means to consistently perform the activity accurately, skillfully, and in the appropriate time and place. Under the competency column indicate how competent you feel in each using the following scale:

3 = Competent, no supervision/assistance
2 = Competent, guidance only
1 = Minimal competence
0 = No confidence

	Exposure					Competency			
	0	**1**	**2**	**3**	**4**	**0**	**1**	**2**	**3**
Evaluation Procedures									
1. Blood Pressure									
2. Respiratory Rate									
3. Heart Rate									
4. Lung Sounds									
5. Heart Sounds									
6. Capillary refill									
7. Values for SaO2									
8. Identification of lines and tubes									
9. Identification of equipment in ICU									
10. Read and interpret vital signs									
Procedures & Process Skills in the Acute Setting									
1. Ability to safely determine appropriateness of treatment									
2. Ability to make appropriate adjustments to patient response									
3. Ability to safely perform:									
a. ROM									
b. Bed mobility									
c. Transfers									
4. Use of proper body mechanics									

PLEASE SEE REVERSE

Post-Simulation Confidence and Competency Scale/Satisfaction Survey (Page 2)

Affective Skills									
I am confident in my ability to competently…									
1. Give instructions to patients									
2. Discuss PT management with patient									
3. Interact with other health professionals									
4. Request more or less help or supervision									

	N/A	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Simulation Experience						
1. Simulation lab improved my understanding of physiological response.						
2. Simulation lab improved my basic physical assessment skills.						
3. Simulation lab improved my understanding of indications and precautions for lines and tubes.						
4. When compared to lecture-based classes, I remained more engaged during simulation lab.						
5. The content of the simulation labs reinforced other coursework.						
6. Working with this simulated case has enhanced my educational experience.						

	Yes	No
1. I would like more simulation labs in my professional curriculum.		
2. I would consider taking an interactive "patient simulation" elective lab.		
3. I would consider taking an interactive "patient simulation" elective course.		

Comments: ALL suggestions will be considered!

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THANK YOU!!!