Evaluation of High Fidelity Simulation within a Baccalaureate Assessment Course:  
Bridging the Challenges of Academia within the Classroom  

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ABSTRACT

The purpose of this quasi-experimental research was to investigate the impact of high fidelity simulation on knowledge and confidence levels among undergraduate baccalaureate nursing students within a Health Assessment course. Due to the decrease in nurse educators and limited clinical placements in hospital settings, innovative teaching methodologies to teach clinical and assessment skills need to be integrated within nursing programs. The participants in this study were first semester junior level nursing students from three baccalaureate level Health Assessment classes. Two classes of approximately 15-20 students each were exposed to simulation- an actor (standardized patient) or a high fidelity simulator while the third group experienced a traditional classroom and lab without simulation. A pre and post test was designed to measure knowledge and a survey instrument was used to measure student confidence levels before and after the learning experience. Results of the study have implications on the development and integration of innovative teaching pedagogies for nurse educators.

Keywords: Simulation; high fidelity simulation (HFS); innovative pedagogy; nursing education; education; standardized patient

INTRODUCTION

Simulation has been used in a variety of ways in diverse environments. Business and education have incorporated the idea of simulation as problem-based case scenarios within a realistic setting [1] whereas, in healthcare, simulation adds the benefit of a device, such as VitalSim™ that students integrate within a case-based scenario in order to assess a patient.

For the past forty years, both the nursing and education profession has relied on “apprenticeship” models to assist students to gain critical knowledge and skills. In nursing, the apprenticeship model uses clinical instructors to teach eight to ten students at a time on hospital units or in other clinical settings. Unfortunately, the apprenticeship model does not provide for consistency in learning outcomes. Student experiences depend on what type of patients are at the facility during their clinical experience. Inconsistency of experiences, lack of placements for students, and decreased faculty have created a void in nursing education that could possibly be filled with the integration of innovative technology [2]. One such innovation is the use of high fidelity simulation within the classroom and on campus in a nursing lab environment. Simulation as an instructional technique can provide a learning environment in the classroom that is as realistic as possible to the clinical setting (patients on nursing units at the hospital). There are several nursing schools throughout the country that are investigating the use of simulation to replace or enhance clinical experiences at health care facilities [2] Nurse educators around the country are engaged in debate over the issue of simulation replacing clinical instructional time for students at hospitals and clinical settings [2].

The integration of simulation in the curriculum can assist students to retain knowledge and develop and refine their critical thinking skills for nursing and education students. According to Griffin-Sobel (2006), simulation provides an opportunity for students to practice both cognitive skills (critical thinking), such as knowing what to do and psychomotor skills, such as the actual teaching [3]. There is a plethora of technology that surrounds everyone, both in academia and the work environment. Within the nursing profession for example, technology is used in multiple media
such as PDAs (personal digital assistants), bedside computers, and continuous monitoring equipment in acute and community based settings [4]. Therefore, it is imperative that nursing students gain proficiency performing clinical skills, in addition to retaining factual knowledge.

To be effective, simulation should be aligned with goals, skills and knowledge acquisition, competency testing, critical thinking, and best practices while integrating a variety of realistic case scenarios [5]. The integration of simulation as a teaching and learning pedagogy has been shown to be effective in teaching nursing students [6]. One of the more recent types of simulation is the integration of standardized patients, or actors, trained to perform for specific training purposes in a safe learning environment [7] [8]. The purpose of this study was to determine whether or not there was any difference between three instructional techniques (simulation with use of VitalSim™ or actor and traditional classroom learning) in terms of knowledge acquisition and confidence among undergraduate baccalaureate students in a Health Assessment class.

PROBLEM STATEMENT
To what extent can simulation as an instructional technique assist students in learning basic nursing knowledge?
This study investigated whether simulation technologies increased nursing students’ knowledge and confidence.

Significance
This study investigated whether simulation technologies increased nursing students’ knowledge and confidence. Simulation can provide consistent learning scenarios in which every student experiences a variety of “patients” and is guaranteed similar learning experiences. In this way, students may be better prepared academically and more likely to gain knowledge. Simulation can assist in promoting consistent learning and supplementing or replacing clinical placements in hospitals and clinics. These placements are becoming increasingly difficult to locate as more schools of nursing are expanding enrollments and there is increased competition for sites. At the same time the demand for nurses in the workforce is growing. As many of these health care facilities are dealing with nursing shortages, it is becoming more difficult for them to accommodate large numbers of students [2]. Moreover, nursing programs have increased their enrollment of nursing students, and therefore need more patient care units to teach the students in the hospitals. Simulation is an effective instructional technique that can promote teaching consistency, reduce the need for clinical placements, and provide a less stressful environment to prepare students for actual patient care. The results of this study may be useful for nursing schools in the improvement of instructional techniques in nursing education and assist with the clinical learning environment that are becoming more difficult to find. Additionally, results from the study can be extrapolated to educating teachers as well.

SETTING and SAMPLE
The sample used in this research was a sample of convenience, consisting of 51 undergraduate junior first semester nursing students preassigned to three different health assessment classes from a mid-sized, comprehensive Mid-Atlantic metropolitan university.

Participants
Approximately 94 percent of the students were females, leaving 6 percent (3 students) that were males and coincidentally 1 male was in each class. Approximately twenty percent (10) of the students had earned previous bachelor’s degrees and one student had an associate arts degree. Out of the ten students that previously earned a bachelor’s degree, two had business degrees, and three had degrees in biology. Ten percent of the students were not born in the United States and their first language was not English. Approximately 75% of the participants in this study were single unmarried Caucasian female between the ages of 20 and 30.

RESEARCH HYPOTHESIS
In order to understand the impact of simulation on knowledge acquisition and confidence levels, the following hypotheses will guide the research:

1. There will be no difference in student knowledge based upon the instructional treatment – integration of HFS (VitalSim™), integration of actor (standardized patient), or traditional learning. P< .05
2. There will be no significant difference in student learning retention (one month) based upon the instructional treatment – integration of HFS (VitalSim™), integration of actor (standardized patient), or traditional learning. P< .05
3. There will be no difference in students’ confidence levels based upon the instruction treatment – integration
of HFS (VitalSim™), integration of actor (standardized patient), or traditional learning. P< .05

LIMITATIONS
This study was conducted with the following limitations acknowledged:

1. The selection of participants was limited to 51 eligible students taking a nursing course in the fall 2007. The sample was one of convenience and therefore, introduced bias. Results of this study were not generalizable beyond the sample.

2. The high fidelity simulator that was used is one of many, but was selected for its ease of use. A limitation of this system was that only selected lung sounds are available for use with this high fidelity simulator.

3. There are several other simulators on the market. Since the study was limited to the integration of the one simulator, results can only be generalized to the integration of the selected simulator.

4. While each class had the same instructor who used the same text book, lesson plan, and syllabus, it is possible that the instructor employed different teaching methods within each class on the specific day that the lecture was presented.

5. The research used student self assessment of self confidence levels. Although it is assumed that students will be truthful to themselves, students might not have taken the time to read questions, and this might have caused variation in some of the results.

RESEARCH DESIGN
This study was conducted in the fall 2007 semester and used a sample of convenience. The course, from which the sample was drawn, is a 15-week, three-credit course, consisting of a lecture and laboratory component. Students attended class one day a week for five hours while simultaneously attending a four-hour clinical day with another instructor at a facility off-campus, but within a ten-mile radius of the university. The course entitled, “Health Assessment across the Lifespan” is a requirement that every first semester nursing student must take and pass in order to progress in the program. There are three sections of the course, each with an enrollment of approximately 15-20 students. The class is offered to current first semester nursing students in the junior level of college every fall and spring semester. Students are enrolled in this course, along with five other courses taken concurrently in the first semester, totaling 17 credits.

The design specifically used in this research was a nonequivalent control group design. Three different classes of Health Assessment were used in this research. The groups were formed by the administrative assistant who assigned students to classes based on when they sign up for classes. She assigned students to different groups and that determined which classes the students attend. While the class assignments are not random, students are placed alternately in Health Assessment sections based on when they see the administrative assistant to register for classes. The administrative assistant does not take requests for students to be in specific classes. The instructional treatment was assigned randomly to the three groups by tossing a coin to determine which group specifically received the specific learning intervention.

Tools
There were two tools that were used in the study. The first tool was a pre-post knowledge test was developed and reviewed by six experienced faculty members in the area of content, testing and evaluation with a Chronbach coefficient alpha of 0.74. Additionally the knowledge test had a content validity index (CVI) of 0.93. The second tool was a self-perceived confidence survey developed by Ravert (2002) and had a Chronbach coefficient alpha of 0.76 [9]. The confidence survey consisted of twenty questions rating each question using a scale from 1 (not confident at all) to 5 (extremely confident). Both the pre knowledge and pre confidence survey were administered prior to the content being taught. The post-test and survey were administered within one week of the case study experience and again one month prior to the case study experience, whether it was the simulation or non-simulation experience. Students were informed that the results of the tests and surveys had no implication on their overall course grade. The study was approved by the University’s Institutional Review Board (IRB) for Research Involving the Use of Human Participants granted under the Exemption Number 04-1X09 on December 12, 2006.

DATA COLLECTION PROCEDURE
Data collection for this study was conducted using a hand written pre-post test and confidence tool completed the pre-test post-test and confidence survey at three different intervals: 1 week prior to the lecture (pre); at the conclusion of the
simulation (post 1); and 1 month after the simulation experience (post 2).

Groups and Procedures

All three groups were given the pre knowledge test and confidence survey prior to being exposed to the respiratory content which occurred one week prior to day one since students prepare for class by reviewing the textbook and notes before the content was presented. The second week students received a Power Point in class lecture, had access to videos online, presented with a case study pertaining to the material, and listened to audio tapes containing lung sounds in class with access for out of class review. The following week (week 3) the post test and confidence survey were given to all students. One month after the instructional treatment was given, students were once again given the knowledge test and confidence survey. Students were made aware that completing the pre test post test and confidence survey had no effect on the student grade or status within the nursing program.

The research was conducted over a five week period of time where students were also exposed to one weekly four hour day with a clinical instructor to practice assessment skills including respiratory assessment. Additionally students attended four other classes consisting of pharmacology, skills, a writing course, and pathophysiology. The nursing program is rigorous and students are exposed to a massive amount of information weekly.

DATA ANALYSIS

Data was entered into a statistical analysis package (SPSS) for analysis. A dependent t test analyzed the difference between the post-test scores among the three groups. An analysis of variance (ANOVA) determined the difference between study groups on the student confidence survey composite scores. A one-way ANCOVA was used to equalize the groups since the groups were not the same at the beginning as demonstrated by the preknowledge test results.

FINDINGS

All three groups had improvements between the pre and post 1 knowledge test and confidence survey. A statistical significant difference was found between the Actor and Traditional groups after the post 1 knowledge test favoring the traditional group (see Figure 1). The VitalSim™ group improved significantly in confidence between post 1 and post 2 survey results (see Figure 2). Post hoc confidence comparisons demonstrated that the VitalSim™ group was more confident in: appraisal, assessment, history, and auscultation.

Figure 1 Mean Knowledge Scores by Group over time

Figure 2 Mean Confidence Score by Group over time

Patterns in the individual questions from the twenty question confidence survey were analyzed. Pairwise t-tests were performed on the individual items on the confidence survey. Group differences and individual item responses were tested using pairwise t-tests. Upon analyzing individual items on the confidence survey over time in groups, there were significant differences found in four items of the confidence survey. The four items out of twenty that showed a consistent difference were appraisal, assessment auscultation (listening to sounds with a stethoscope) and history. The VitalSim™ group demonstrated statistically significant higher confidence means.
for all four items compared to the Traditional group and three out of four items compared to the Actor group. The VitalSim™ provided the opportunity for students to learn by taking their time observing, assessing, and deciding the intervention for the patient without the fear of something detrimental happening to the patient. The other sixteen items refer to areas that the VitalSim™ might not have an advantage over such as: taking vital signs and counting respirations (items 1, 2); applying and monitoring oxygen (items 5, 6, 7); talking, touching, initiating conversation, and questioning the patient, (items 10, 11, 12, 14); working in small groups (item 13); documenting, observing respirations, intervening (items 17 - 20). It was expected that the VitalSim™ would have had an advantage over determining abnormal lung sounds (item 16); however, the students might not have the ability to accomplish this at the first semester of the nursing program.

Summary of Findings

Descriptive statistics were calculated which revealed that all groups had improvements between the pre and post 1 knowledge test and confidence survey. A one-way ANOVA was computed to determine if there was a significant difference between the three groups after the pre knowledge quiz was administered. There was an overall significant difference found between the groups so Bonferroni adjustments were made in order to conduct post hoc comparisons. A one-way ANCOVA was performed to determine if there were any statistically significant differences between groups in knowledge and confidence scores. There was a statistical significant difference found between the Actor and Traditional group after the post 1 knowledge test favoring the traditional group. There was no significant difference found between the simulation groups, or between the VitalSim™ and the Traditional groups on post 1 knowledge test and confidence survey scores. Additionally, there were no significant differences found between the three groups after the post 2 knowledge tests or in the confidence survey.

There was a significant overall difference in confidence at post test 2. Post 1 to Post 2 confidence mean scores within groups and item differences within the confidence survey were explored. T-tests demonstrated that the VitalSim™ group improved significantly in confidence between post 1 and post 2 survey results. Post hoc comparisons were performed on the individual items on the confidence survey. The areas that students were more confident were appraisal, assessment history, and auscultation. The VitalSim™ group had statistically significant higher mean confidence scores in the areas of appraisal, assessment history, and auscultation than the other two groups.

CONCLUSIONS

The results of the study demonstrate that simulation can be an effective instructional pedagogy. Simulation incorporates both Bandura [10] and adult learning theories [11] which provides an interactive learning environment. This study also demonstrated that simulation does assist students with increasing their confidence and knowledge retention within a safe learning environment integrating debriefing, immediate feedback, and guided reflection. To be effective, simulation should be aligned with goals, skills and knowledge acquisition, competency testing, critical thinking, and best practices while integrating a variety of realistic case scenarios. Simulation is an effective adjunct to the clinical setting, providing close to real-world learning while incorporating kinesthetic learning with groups of students gaining knowledge together versus the clinical setting where fewer students gain while maintaining patient dignity and confidentiality.

Simulation currently is integrated within hospitals to train medical personnel to acquire new skills and techniques as new medical equipment is purchased. Lower cost simulators, such as the VitalSim™ have been shown to be cost effective for training purposes.

Simulation has enabled students to demonstrate the link between theory and practice, synthesize knowledge and gain clinical confidence. Future research is necessary to connect the increase confidence levels with improvement in critical thinking; best simulation practices; and demonstrating the effects of simulation on clinical learning. Educators whether in the business, teacher education, or nursing classroom, need to develop and integrate realistic case-based scenarios, standardized simulation forms, and reliable testing checklists while making the simulation available to students.

REFERENCES


