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The Effects of a High Fidelity Simulation Experience on Students' Knowledge

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By

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Abstract

The purpose of this study was to identify and examine the effects of high-fidelity simulation on the knowledge of second semester associate degree nursing students at a small community college. The research question addressed was: Does high–fidelity simulation increase the knowledge level of second semester ADN students. Researcher developed pre and post tests were used to measure the effects of the simulation on the students' knowledge level. The data was analyzed using the Statistical Package for Social Sciences, Version 19. Findings revealed a significant difference between the scores of the pre-test and the scores of the post-tests. The results of this study supported the use of the Nursing Education Simulation Framework (Jeffries, 2007) and identified the need for further research in a larger geographical area with multiple community colleges for a larger sample size.

Table of Contents

List of Figures

List of Tables

Chapter I

Introduction

High-fidelity simulation has been embraced by the nursing community despite the lack of research. Simulation in nursing is becoming a popular way of enhancing the skills of nursing students. With today's focus in healthcare on patient safety and quality of care, it is important for the nursing faculty to incorporate learning techniques into the curriculum that will enhance the knowledge of the students and provide opportunities for hands on experience (Solnick & Weiss, 2007).

The simulation experience aims to imitate reality while offering skills-based experience and provides the student with the opportunity to be involved in patient experience before they have the experience at the bedside. It is an interactive scenario where the students actually get to use their skills and have hands on experience (Solnick & Weiss, 2007). Simulations take place in a safe, controlled, nonthreatening environment. The realistic hands-on experience enhances the students' knowledge before they take care of real patients.

There are many advantages to high-fidelity simulation in nursing education. The environment for the simulation is designed to be a supportive environment where the student can practice skills without causing harm to the patient (Solnick & Weiss, 2007). The high-fidelity simulator can also be used on all educational levels in a variety of areas. For example, students can use the simulator to practice intravenous (IV) catheter and foley catheter insertions without causing the patient distress. Simulated experiences allow for complex issues to be taught to several students at a time and the scenario can be practiced multiple times.

High-fidelity simulators provide for a better educational experience. As the students work with the simulators, the experience becomes more realistic as the patient begins to breathe, talk, and have a heartbeat, bowel sounds and peripheral pulses. When an intravenous catheter is inserted, red fluid in the mannequin flashes into the IV catheter to show the insertion was successful. The simulator has a video component that will record the simulation as it is in progress. This can be viewed during the debriefing session and the students and facilitator can evaluate the simulation (Henneman & Cunningham, 2005).

It is impossible for nursing instructors to teach students how to handle every situation they will experience. Critical thinking is an integral part of nursing and is an important skill to have when facing challenging situations. The National League of Nursing (NLN) (1991), mandated that critical thinking content be included in the curriculum for all nursing schools. The National League of Nursing (2003) stated that nurse educators are to present a learning environment that facilitates students' critical thinking skills. Since this requirement by the NLN, many nurse educators have researched critical thinking and how it can be applied to the nursing practice. Critical thinking is defined by some people as the thought process underlying effective clinical reasoning and decision making (Oermann, 1997). The high-fidelity simulator gives the students an opportunity to increase their knowledge in this area and have hands on experience with the critical patient.

Background

Simulation has been used for many years in different forms. The military has used forms of simulation to train pilots and soldiers in scenarios that would not be available in

other ways (Bradley, 2006). Nuclear power plant personnel use simulations to help prepare for disasters. This is done to ensure that personnel will respond quickly in the event of an emergency (Ellis & Hughes, 1999). In the past, nursing has used different forms of simulation to train nurses at all levels. Just recently, simulation for the purpose of nursing education has increased due to the need for more training (Nehring, 2008).

Significance

In some areas in the United States, nursing schools are competing for clinical space and instructors to teach students in the clinical setting (Nehring, 2008). Schools of nursing are integrating high fidelity-simulation into the nursing programs to enhance learning and to provide extra clinical experiences; yet there is minimal research to support this form of learning (Lasater, 2007). Trossman (2002) added that there are not enough nursing instructors to give the students the clinical hours and experiences needed. Jeffries (2005) pointed out that it is a challenge for a nursing educator to provide the experience-based training needed, since actual clinical time is limited and the students may never have the opportunity to experience situations that may easily be created and experienced in the simulation lab. Jeffries also added that one of the most important aspects of simulation is the feedback that the students get regarding their ability to process the knowledge they have acquired in the classroom. The high-fidelity simulation mannequins can be programmed with real life medical scenarios that will test the students' knowledge, improve their skills in a safe environment, can replace the clinical setting, and provide students the opportunity for extra hands on experience.

Research Question

The research question for this study is: Does a high-fidelity simulation increase the level of nursing students' knowledge?

Conceptual Framework

For this study, Pamela Jeffries Nursing Education Simulation Framework was used in order to show the effects of a high-fidelity simulation experience on nursing students' knowledge. This framework was designed specifically for evaluating simulation in nursing education. Jeffries framework consists of five major components: 1) the teacher, 2) the student, 3) educational practices, 4) design characteristics of the simulation, and 5) expected outcomes from the simulation. Each component has factors that affect the component (Jeffries, 2007). (See Figure 1)

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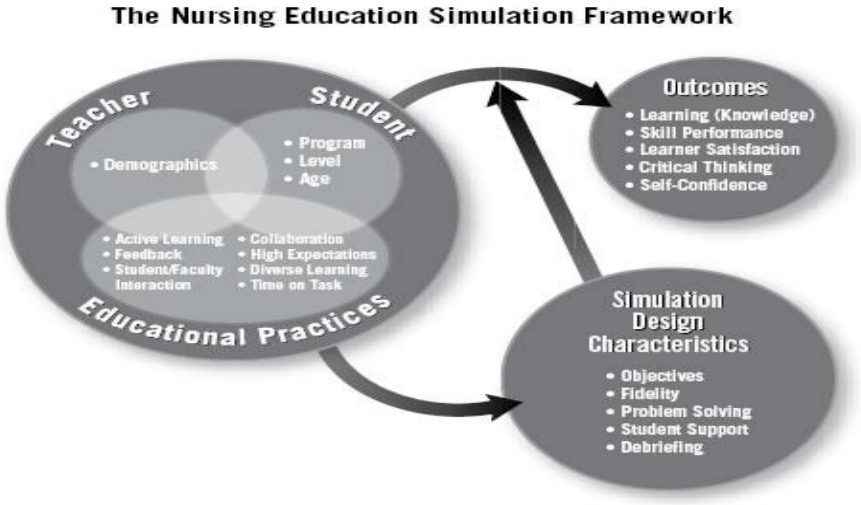

Figure 1. Nursing Education Simulation Framework

Teacher. The teacher is the first component in the framework and the one most significant for the success of the simulation. Though the simulation is student-centered, the teacher plays the role of facilitator and evaluator. As the facilitator, the teacher may provide encouragement throughout the simulation experience and as an evaluator, the teacher serves as an observer. For the simulation to go smoothly, the teacher must be comfortable with the equipment and be prepared for the simulation being used (Jeffries, 2007). In this study, the researcher will take the role of teacher.

Student. The student is another component of this framework. Although simulations are different, students are expected to be self-directed and motivated. Telling the students the rules for the simulation and what their role will be will help them to be more responsible. Students are unique and bring different characteristics to the simulation experience, including age, culture, educational level, and former training (Jeffries, 2007). In this study the student will be considered to be the nursing student experiencing the simulation.

Educational Practices. The educational practices factor of the framework addresses the issues of active learning, diverse learning style, collaboration, and high expectations. All of these features need to be considered when designing a simulation in order to improve student performance and increase satisfaction (Jeffries, 2007). Active learning is important for the student to remain engaged in the learning process. Active participation has been known to improve critical thinking skills and provides the educator with the opportunity to evaluate the learner's problem-solving and decision-making skills (Billings & Halstead, 2005). Feedback is incorporated into the active learning process, but should not interfere. It should instead enhance the learning experience and encourage

the student. High-fidelity simulations allow for students with different learning styles. Understanding that students come to the simulation with different learning styles will help the instructor optimize the learning experience. The simulation can be altered to meet the needs of the students (Jeffries, 2007). According to Billings and Halstead (2005), the student-faculty relationship is important to learning experience. Collaboration can promote a positive learning environment if the communication lines are left open. This will foster an environment of mutual respect in which the student feels comfortable asking questions and making decisions. High expectations are an important aspect in the simulation experience for the students to do well and succeed. The students should set personal goals and get advice from the faculty on how to achieve these goals. When the students have high expectations from the simulation experience and faculty support, positive outcomes are usually achieved (Vandrey & Whitman, 2001). For the purpose of this research, the active learning feature included the simulation and the students' participation in this experience. Student support was given during the simulation in a form of cues from the facilitator and from cues preprogrammed into the mannequin.

Simulation Design Characteristics. The design of the simulation should include five features: objectives, fidelity, problem solving, student support and reflective thinking (debriefing). The amount of each feature that is included in the simulation depends on the purpose of the simulation (Jeffries, 2007). According to Jeffries (2007), objectives are the tools that will guide the learning process in the simulation. Objectives should be realistic and should reflect the intended outcome of the simulation, specify expected learner behaviors, and include enough information for the learner to participate effectively. Once the simulation is completed, reference to the objectives can be used in the debriefing.

Fidelity is the extent to which the simulation mimics reality. There are three levels of sophistication; high, moderate, and low. A high-fidelity simulator is a full size, interactive, realistic mannequin that can be programmed to demonstrate the signs and symptoms of an illness a patient may be experiencing in a problem-based scenario. In developing a high-fidelity simulation, the real life situation should be replicated as closely as possible (Jeffries, 2007). Problem solving is related to the complexity of the simulation, which needs to be based on the knowledge and skill level of the students. A complex simulation should be at a level that is challenging but attainable for the learner. The simulation will not be effective if it is not attainable for the learner. It is important to replicate real life situations, but it is also important not to overwhelm the learner with too much information (Rauen, 2001). The support feature of the design characteristics component focuses on providing assistance to the student. In designing the simulation, the educator should decide at what point support will be provided to the student by the facilitator. The assistance should be in the form of cues that allow the student to continue the simulation. Cues can be programmed into the simulator that voice pain, nausea and just not feeling well (Jeffries, 2007). Cues like this will alert the nurse to the patient's pain, and it is hoped, will direct attention to the patient problem.

Reflective thinking and debriefing follow the simulation experience with students and faculty examining what happened and what was learned. This session allows the students the opportunity to assess their actions, decisions and ability to deal with the unexpected (Henneman & Cunningham, 2005). This should occur immediately after the simulation so the thoughts of the students are not forgotten or distorted. The reflective thinking session should be guided by the facilitator and remarks should focus on the learning

outcomes (Jeffries, 2007). In this study the feedback feature involved the debriefing session led by the facilitator. This gave the participants time to reflect on the simulation; what went well and what did not go well.

Outcome. The outcome component of this framework involves outcomes such as knowledge gained, skills performed, learners' satisfaction, critical-thinking, and self-confidence. The effectiveness and the knowledge gained are measured by the outcomes. The outcomes are predetermined and guide the teacher to the overall effectiveness of the simulation. This simulation used a high fidelity mannequin with objectives and outcomes that were clear and measurable. The simulation was administered at the core level, which is the basic level for these nursing students. Outcomes in this study were considered to be the students' knowledge. All of the components in this framework influence the outcome.

Chapter II

Literature Review

There have been many studies done on the effectiveness of simulations in nursing education. More and more schools are using this technique as a mean to educate their nursing students. A review of current literature demonstrating ongoing research was conducted utilizing the following databases: Elton B. Stephens Publishing Company, Cumulative Index to Nursing, and Allied Health Literature. Key words used to conduct the literature review were: High-fidelity simulation, knowledge, critical thinking, and nursing education.

Usefulness in Teaching

Kardong-Edgren, Starkweather, and Ward, (2008) used a prospective, descriptive, repeated measures design to research the integration of simulation into a clinical foundations nursing course. The purpose of the study was to investigate the faculty and student perceptions of how the simulations assisted in acquisition of clinical skills. The sample included students enrolled in their first clinical course in a bachelor's of nursing program. The Jeffries Framework was used to guide the research. Following the simulations, the students reported they felt better able to handle patient care. The faculty felt that the creativity of the simulation was a positive experience, but were unable to be the voice of the patient, run the mannequin, and monitor the student in the scenario. Repetitive practices were also noted as a positive by the faculty members; however, there were some limitations. The design of the study did not allow for comparisons of students exposed to simulation to those who had not been exposed, and many novice faculty members ran and debriefed their own scenarios.

According to Cant and Cooper (2010), simulation is an educational process that can replicate clinical practices in a safe environment. These researchers used high fidelity simulation with mannequins to aid in teaching the students, along with traditional methods of teaching. The question was how effective is simulation as a method of teaching and learning compared to other strategies. Pre and post tests were used in the research. This research was compared to a control group that received traditional teaching strategies. The researchers performed 12 studies, and of the 12 studies, four showed significantly higher means for the experimental versus the control group. Even though studies showed that simulation was a valid method of education, only half of the studies that compared simulation with a control group were able to show additional gains in knowledge or critical thinking.

An investigation by Hicks, Coke, and Li, (2009) compared the effectiveness of simulation to clinical experience for nursing students enrolled in a pre-licensure curriculum. The objective was to investigate the effectiveness of high-fidelity simulation alone and in combination with clinical experience. A randomized design was used along with a Likert scale for measurement. Of the 58 students that participated, more than half the students already had a bachelor's degree in other fields and 30 % had work experience in health care. The students had a multiple choice exam prior to the simulation to test their knowledge of the material covered. After the simulation, they were given another multiple choice exam. Based on written examinations of the content taught, the participants retained an average of 83% of the knowledge gained. No significant multivariate differences in change of knowledge were found.

A study conducted by Ying (2009) involved first year nursing students and a scenario involving a respiratory patient with a pleural effusion. For this scenario, the patient was scheduled for a thoracentesis, but was found breathless on morning rounds. The oncoming nurse was to intervene and work through the process to the outcomes. The researcher believes placing students in scenarios that mimic real life situations gives them the opportunity to understand the relevance of the clinical setting and be able to manage it effectively. This study also used Jeffries Framework and showed that the design of simulation can be an effective teaching modality.

Self-confidence and Student Satisfaction

Smith and Roehrs (2009) examined factors correlated with two outcomes of high fidelity simulation: student satisfaction and self-confidence. A descriptive, correlational study was used to examine the effects of simulation on two outcomes (student satisfaction and self-confidence), as well as the factors correlating with these outcomes. Descriptive statistical analysis and correlational statistical analysis were both used in this research. The theoretical framework used is the Nursing Education Simulation Framework. The study was designed to measure two outcomes: student satisfaction and self-confidence. The sample for this research consisted of junior nursing students in a traditional BSN program in their first medical/surgical fundamentals course. Two instruments developed by the National League of Nursing were used. These instruments included the Student Satisfaction and Self-Confidence in Learning Scale and The Simulation Design Scale, both of which were self-report instruments using 5-point Lickert scales. Students participated in groups of four, with two students being the nurses and two being the observers. The two nurses did an assessment and gave medications.

The simulation was stopped after they intervened for the patient having respiratory distress. After the simulation, a debriefing was held. Most of the participants (90 %) were female with an average of 23.4 years (SD=5.4). Over two thirds (69 %) had no experience working in a health care setting, other than nursing school. For the ones with health related experience, most reported being certified nursing assistants or patient care technicians.

In order to understand the effects of simulation in nursing education, there has to be an abundance of research. Henneman and Cunningham (2005) evaluated senior nursing students' learning experiences with high fidelity simulation in an acute care/critical care course. Faculty used a simulation design framework for the implementation of the scenario. They also developed a debriefing process to promote student reflection. With practice, students and faculty became increasingly comfortable with high-fidelity simulation and expressed general satisfaction with this learning approach.

Lewis and Ciak (2011) initiated a simulation experience to study the impact of simulation in nursing education. The convenience sample consisted of pre-licensure students in a Growing Family Nursing course during a period of four semesters. The simulation focused on Problem Based Pediatric and Obstetric Simulation for Nurses and Nursing Students. Eight high-fidelity scenarios were selected for the students to experience through the day. The students were to make an assessment and provide interventions. A tool developed by the National League of Nursing to measure satisfaction and self-confidence was used. A quasi-experimental design was used to measure the effectiveness of the simulation experience and pre-tests and post-tests were

given. A significant gain in knowledge was noted on the pre and post-tests. For each semester, a statistically significant increase in knowledge was measured using a paired student t-test. The researchers concluded that simulation provides effective means of improving knowledge in a safe environment (Lewis & Ciak, 2011).

O'Boyle-Duggan (2010) developed a simulation to explore challenging behavior. This simulated experience brings together theory and practice for planning individualized care for people with challenging behaviors. The author explores live simulation as a strategy for teaching nursing students about person-centered health care for clients who have learning disabilities and challenging behaviors. This method enabled students to learn and practice safely and effectively, and then complete a questionnaire about the experience. Most of the students recorded that they had improved attitudes and insights, and increased competence and confidence.

Clinical Judgment and Skills

Research by Lasater (2007) investigated the interaction among the four dimensions of clinical judgment related to a simulation activity. The four dimensions were: students' self-report of their clinical judgment skills, students' aptitude of critical thinking and observations of students' clinical judgment skills during simulation, and students' experience followed through a focus group. The sample consisted of 48 junior nursing students divided into groups of 12. Some pre-teaching was done on the scenario. For the simulation, three students participated at a time with one acting as the nurse. This student playing the role of the nurse was responsible for primary care, delegation, and interventions. After the scenario, the facilitator had debriefing sessions. This study found weaknesses and strengths. The students felt the simulation served as a bridge to bring

learning skills and psychomotor skill to the classroom, and that it surpassed having to read the material from the book. Limitations mentioned included: the inability of the Sim-man to express nonverbal skills, the inability to assess neurological status, and the students reported feeling silly talking to a mannequin.

Communication problems among the interdisciplinary team have been linked to errors in patient care. According to Dillon, Noble, and Kaplan (2009) high-fidelity simulation is a great way to provide students with opportunities for practicing patient care skills and communication in a safe environment. Within this research, a mock code was used in the simulation as a collaborative exercise for the students. This study was used to analyze the students' perceptions of a collaborative relationship before and after the simulation experience, and to determine the usefulness of the collaboration approach to learning through the use of high-fidelity simulation.

Pretests and posttests were used to identify the students' perceptions of the collaboration using high-fidelity simulation, as well as open ended questions to evaluate the usefulness of the simulation as a learning experience. The sample was fourth-year baccalaureate nursing students and third-year medical students at an urban university. A convenience sample was used.

Quantitative and qualitative data was collected, along with demographic data to describe the sample. The Jefferson Scale of Attitudes Toward Physician-Nurse Collaboration was used to measure medical and nursing students' perceptions of collaborations. This is a 15 item, four point Likert Scale with a reported reliability ranging from 0.70 to 0.86. Prior to analyzing the pretests and posttests scores, reliabilities were calculated Chronbach's alpha coefficients. Descriptive statistics were used to

describe the sample. The results showed that the nursing students had higher pretests scores than the medical students, but the medical students had higher gains in the posttests. Prior to the simulation, the medical students had mixed feelings concerning collaboration with nurses, but after the simulation, they agreed that nurses have an important role in the collaboration process. Both medical and nursing students saw collaboration and teamwork as an important part of the nurse/physician relationship (Dillon et al., 2009).

Fero et al. (2010) researched the relationship between critical thinking skills and performance in clinical simulated scenarios. A sample of 37 nursing students participated in the measurement of critical thinking skills and simulation based performance using videotaped vignettes, high fidelity simulation, and California Critical Thinking Skills Test. The simulation based performance was rated as "meeting" or "not meeting" overall expectations. Test scores were rated as strong, average, or weak. The results indicated that most students did not meet the overall expectations. They found that most problems were noted in recognizing the problem and reporting to the physician. There was no difference in method of assessment (P=0.227). More students met expectations for initiating nursing interventions. The relationship between videotaped vignette performance and critical thinking skills was not statistically significant, except for problem recognition. It is concluded that students had difficulty meeting expectations in clinical simulated scenarios. Further research is needed to determine if simulation-based performance correlates with critical thinking skills in the clinical setting.

Alinier, Hunt, Gordon, and Hardwood (2006) analyzed the effects of scenario-based simulation training on nursing students' clinical skills and competence. A

pretest/posttest was designed for volunteering undergraduate students (n=99) from second year Diploma in Higher Education Program in United Kingdom. Students were randomly selected to be in a control or experimental group. All students were tested and retested and given a questionnaire. The control and experimental groups increased their tests scores on the second test. Mean test scores increased by 7-18 and 14-18 percentage points. The difference between the means was statistically significant ($P< 0.0001$). According to the Likert Scale questionnaire, the students' perceptions of stress and confidence were very similar. It was concluded that this type of simulation is very useful in nursing education. It enables small groups of students to practice in a safe and controlled environment. It enables them the opportunity to react to a critical situation under safe conditions. Once the simulation is over, there is a debriefing and the students can reflect on what went well and what they can do better.

With the increased threat of bioterrorism and other disasters, researchers recognized the need for students to understand the roles of each interdisciplinary team member in the event of a disaster. An undergraduate nursing program initiated a simulated disaster for 81 multidisciplinary undergraduate students. A pretest/posttest design was used to evaluate the effectiveness of the preparing for the simulation. All of the students received disaster preparedness in class through classroom lecture, computer programs, and simulations. The students were assigned to five different disaster preparedness teams. The one-way ANOVA tests resulted significant differences between the pre and post-tests, ($p=0.05$) (Hutchinson et al., 2011).

Simulation is used in a variety of clinical settings. A simulation-education team implemented a simulation program for experienced bone marrow transplant nurses

(Kuhrik, Kuhrik, Rimkus, Tecu, & Woodhouse, 2008). Case scenarios and algorithms were developed based on real emergencies. The goal of the simulation was to improve the skills of the nurses, help them to recognize changes in patient conditions, and safely care for the critical patient. The simulation experience involved 12 experienced nurses. Pretests were completed by 11 of those nurses and posttests were completed by all 12 nurses (Kuhrik et al., 2008). Although the post evaluation scores were higher than the pretests, the small sample size limited the ability for sound results concerning the effectiveness of simulation in education. After the simulation, nurses who participated did share that their skills were enhanced as a result of the simulation training (Kuhrik et al., 2008).

Effect on Knowledge

High-fidelity simulation is becoming increasingly essential to nursing education. A pilot study by Cormier, Hauber, and Whyte (2010) examined the relationship between nursing students' being able to prioritize and their interventions and the physiologic outcomes of care using high-fidelity simulation. Erickson's and Smith's expert performance approach was the framework for this study. A quasi-experimental design was used. Participants were taken from volunteers at a large college of nursing in the Southeastern United States. The sample consisted of 15 students who were at the beginning of the third semester of a five semester BSN program. The simulation scenario was that of an adult male with Congestive Heart Failure (CHF). The simulator was programmed to encompass all of the physiological concepts of decompensated CHF. The simulation environment was designed to look like a coronary unit in the hospital. The scenario involved admitting a patient with an exacerbation of CHF. Thirty minutes were

allotted for the participants to complete all of the tasks involved. Two knowledge related measures (fundamentals and Adult Health I course grades) were statistically significant. The authors concluded that more research on this subject is appropriate. The use of simulation allows nurses the opportunity to practice and refine their skills.

The review of the literature demonstrates a variety of research studies involving simulation. The usefulness of simulation in teaching has been reported (Kardong-Edgren et al., 2008; Cant & Cooper, 2010; Hicks, et al., 2009; Ying, 2009). The effect of simulation on clinical judgment and skills (Alinier et al., 2006; Dillon et al., 2009; Fero et al., 2010; Hutchinson et al., 2011; Kuhrik et al., 2008); and satisfaction and self-confidence (Lewis & Ciak, 2011; O'Boyle-Duggan, 2010; Henneman & Cunningham, 2005; Smith & Roehrs, 2009) has been demonstrated. Only one study in the literature review looked at the effect of simulation on knowledge (Cormier et al., 2010). This study seeks to extend the research to determine the effect of a simulation experience on students' knowledge related to Congestive Heart Failure.

Chapter III

Methodology

This research study examined the effects of high-fidelity simulation in nursing education on the knowledge of second semester undergraduate nursing students. In order to obtain the data for this research, the researcher administered a knowledge pre-test/post-test to a group of associate degree nursing students. After taking the pre-test, the students participated in a high-fidelity simulation scenario. There was no class discussion on the topic prior to the simulation. A post-test was administered after the simulation to test the effects of the simulation on the students' knowledge. A debriefing was conducted after the simulation to discuss the scenario.

Setting

The setting for this research is a small community college in western North Carolina. The simulation took place in the nursing lab with a high fidelity-simulation mannequin. The lab is a large room with several low and medium level mannequins and one high-fidelity mannequin. This room is also set up with computers for online simulation scenarios. The area used for this simulation was designed to simulate a basic hospital room with curtains drawn around the bed for privacy. The curtain enclosed area contained a hospital bed, the high-fidelity simulation mannequin lying in the bed, oxygen, suction, heart monitors, blood pressure cuffs and a bedside table.

Sample Population

Approximately 3700 students attend the community college. The nursing program allows fall admission only and accepts approximately 50 students into the nursing program. The convenience sample for the study included 35 nursing students who were

recruited from all students in the second semester associate degree program. Simulation is part of the nursing curriculum, so all of the participants had access to the high-fidelity simulation mannequin in their first semester. This class is approximately 95% female, with ages ranging from 19 years to 45 years of age.

Instruments

The tools used for this research, consisting of a pre-and post- knowledge test, were researcher developed. The tools measured the knowledge of the nursing students prior to the simulation and after participation in the simulation scenario. The knowledge tests were based on a preprogrammed scenario of a simulated congestive heart failure patient. The tools were reviewed for validity by two nursing instructors with several years of teaching experience. Instructor A holds a Master's of Science degree in Nursing and 19 years of experience as a nursing instructor. Instructor A is one of the lead instructors in the nursing program and is involved in hosting webinars for the community college. Instructor B recently received a Doctorate in Nursing Education and has ten years of experience as a nursing instructor in the classroom and in the skills lab.

Procedure

After receiving written permission from the Institutional Review Board at the community college and Gardner-Webb University, the research was explained to the participants. Those agreeing to participate were then asked to sign an informed consent prior to participating in the simulation experience. The participants were asked to sign up for a specific day and time to come for the simulation.

The preprogrammed scenario of a simulated congestive heart failure patient chosen for this simulation experience involved a 72 year old patient with congestive heart

failure (CHF). The patient had come into the hospital with exacerbation of CHF, and was admitted for further evaluation and diuresis. During the simulation experience, the patients' status began to deteriorate.

The researcher served as teacher and facilitated all simulations. The researcher has previous experience in the simulation lab under the supervision of a doctoral prepared educator with over ten years' experience in nursing education. Feedback for the simulation and assistance in preparation was provided by full time educators in the setting that were assigned to the students courses for that semester.

On the day of the simulation, the participants were given the researcher developed pre-test. After the pretest was taken, the participants, in groups of five, were given a report on the simulation scenario for the congestive heart failure patient. The objectives and outcomes of this experience were explained to the participants. The simulation mannequin was pre-programmed with the CHF scenario to enhance the students' nursing skills and encourage critical thinking.

Once the scenario began, the participants were responsible for assessing, monitoring and recognizing the decline in the patient's status and intervening. Each group of five students had 20 minutes to complete the simulation experience. Following the simulation experiences, a debriefing was conducted and a researcher developed posttest was administered. The students have not had CHF content in the classroom but may have had a congestive heart failure patient in the clinical setting. One researcher served as teacher, administering the pre and post knowledge tests and conducting all of the simulation sessions.

Data Analysis

The Statistical Package for Social Sciences (SPSS), Version 19, was used to analyze the data. Descriptive statistics of frequency and measures of central tendencies was performed. Differences in groups were analyzed using the paired samples *t* test.

Chapter IV

Results

Thirty-five students were recruited from an associate degree nursing program. All of the students signed the consent and agreed to participate in the research. The sample included three males and 32 females with the same level of nursing education. Each group of participants had the same amount of time for the simulation experience. Data was collected by using a pretest and posttest that was researcher developed and approved by the institutional review board at the community college and Gardner-Webb University. The data was analyzed by using the Statistical Package for Social Sciences, Version 19.

Research Question*: Does a high-fidelity simulation increase nursing students' knowledge level?*

A paired samples *t*-test was used to measure the effects of high-fidelity simulation on the students' knowledge. The paired samples statistics was significant at the .05 level of probability, t (34) = -10.52, p = .00. The post-test mean score of 98.00 (SD = 3.67) was significantly higher than the pre-test mean score of 87.57 (SD = 5.98).

A comparison of each question revealed major differences in students' choices for the pre- and posttest questions (Table 1). Overall, the range in correct responses on the pretest was three to 34 while the range in correct responses on the post-test was 31 to 35. The major differences in correct responses between the pre and post-test answers were found in question one and question two. Prior to the simulation only eight students could correctly identify the types of heart failure compared to 34 students who could identify the types of heart failure following the simulation. Another obvious difference in knowledge level was revealed in question two regarding the type of heart failure

indicative of fluid in the lungs. Prior to the simulation, only three students could correctly respond compared to 34 students who could correctly respond following the simulation.

Minor differences in correct responses between pre and posttest answers were found in questions five and ten. Prior to the simulation, the majority of students could identify diet restrictions appropriate for the patient with CHF (97%) and the cause of weight gain in a patient with heart failure (91.4%).

Students' posttest scores improved on all but one of the questions, number six. Prior to the simulation, 33 students could identify the most common medication given for fluid retention in the CHF patient. Following the simulation, only 31 students could identify the most common medication given for fluid restriction.

Table 1

Comparison of Correct Responses for Pre and Post Test Knowledge Quiz

Question	**Pre-Test Correct Responses**		**Post-Test Correct Responses**	
	F	%	F	%
1. Types of Heart Failure (HF)	8	22.9	34	97
2. Type of HF most indicative of fluid in the lungs	3	8.6	34	97
3. Identify the color of the skin related to lack of oxygen.	28	80.0	33	94.3
4. Name one nursing diagnosis for CHF patients.	31	88.6	35	100
5. Which diet restriction would be appropriate for CHF patient?	34	97.1	35	100
6. Identify the most common medication given for fluid retention in the HF patient.	33	94.3	31	88.6
7. Which lab value is most important in a CHF patient on diuretics?	31	88.6	35	100
8. What complication should the nurse be alerted to while administering IV fluids to the HF patient?	28	80.0	31	88.6
9. You, as a nurse, have a patient taking carvedilol 6.25 mg p.o. for heart failure. Their blood pressure is 90/48. What should be the nurse's action?	31	88.6	35	100
10. As the nurse, you noticed your patient's weight has increased 4 lbs. since yesterday. What is most likely the cause of this weight gain in a HF patient?	32	91.4	33	94.3

Chapter V

Discussion

Significance of Findings

This research involved high-fidelity simulation using a congestive heart failure scenario. The participants were expected to assess the patient, recognize the decline in his status and intervene. The participants welcomed the opportunity to practice with the simulator and every group worked well together as a team. Communication between the students and between student and facilitator was precise and helped create a stress free environment. The debriefing session after the simulation was a good time for students to ask questions and evaluate the whole experience. The students were very receptive to the feedback from the facilitator.

The results of this study indicated a significant difference between the scores of the pretests and the scores of the posttests with P=.00. The significant difference in the mean scores of pretests and posttests could be explained by the fact that the participants had not had the heart failure content in the classroom at this point and the positive effect of high-fidelity simulation on the students' knowledge between the pre and post-tests. These results supported Jeffries' conclusion that high-fidelity simulation shows promise as an essential teaching strategy for nursing students (Jeffries, 2007).

While students, overall, improved in their knowledge regarding CHF, one question proved problematic for students following the simulation. This could have been due to conflicting information provided in the simulation. Although one researcher conducted all simulation activities, this could have been to a single simulation activity that was presented that did not adher to the guidelines. Videotaping the simulation would allow identification of any variation in the simulation sessions. Although the simulation

did not specifically target the information in the test, it should be reviewed to eliminate any conflicting information.

Implications for Nursing Practice

This study provided descriptive data on the knowledge of students before and after the high-fidelity simulation. The research reinforces the position that high-fidelity simulation is a valuable teaching strategy. Participating in the high-fidelity simulation clearly adds to the knowledge of pre-licensure students in the clinical situation. The statistical results of the instruments used further reinforce the value of high-fidelity simulation. The study revealed that high-fidelity simulation has definite benefits as a teaching method in nursing students because it shows knowledge increases after the simulation experience.

Limitations of the Study

Limitations to this study included that the pre and posttests used for data collection were identical. Some of the participants may have been able to recall questions from the pretests. The small sample size of 35 may have also placed limitations on the findings.

Recommendations for Further Research

Since the research was limited to one geographical area and one small community college, it is recommended that the research be conducted in a larger area in multiple community colleges for a larger sample size. The research could involve different age groups and a more diverse sample.

Importance of the Findings for Nursing

The results of this study supported Jeffries (2007) Nursing Education Simulation Framework. Study findings showed a significant increase in the posttest scores after the simulation. It is recommended that more research be conducted with a larger more diverse sample. According to the literature, high-fidelity simulation is a great way to provide students with opportunities for practicing patient care skills and communication in a safe environment (Dillon et al., 2009). The benefits of the high-fidelity simulation include supportive safe environment for practicing nursing skills, skills can be practiced multiple times, simulation can be used as clinical time and there is no harm to the patient (Solnick & Weiss, 2007). These benefits enhance the outcomes of the education of the nursing students. High-fidelity simulation can assist the student in having realistic expectations of their role as a nurse in the clinical environment that would not be achieved by only receiving classroom lecture.

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