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High-fidelity simulation in nursing practice: the impact on nurses' knowledge retention, satisfaction, and self-confidence

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HIGH-FIDELITY SIMULATION IN NURSING PRACTICE: THE IMPACT ON NURSES' KNOWLEDGE ACQUISITION, SATISFACTION, AND SELF-CONFIDENCE

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ABSTRACT

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Nurses require ongoing opportunities to expand knowledge and skills; this expansion of knowledge and skills is one aspect of continued competence. One method that may be used to maintain and refine knowledge and skills is participation in continuing education activities. However, there has been little inquiry into creative strategies used in conjunction with continuing education activities for practicing nurses in the clinical arena. One such method is simulation--it represents an approach to learning that allows participants to integrate theory and practice and experience complex problems without jeopardizing patient safety. Experiences related to high-risk patients cannot be created on demand and the prevalence of these experiences is unpredictable. Thus, it is important to find the most effective way to assist practicing nurses to maintain and enhance knowledge and skills for high-risk populations such as those found in the neonatal intensive care unit (NICU). A quasi-experimental, pre-test, post-test mixed design with a control group of 48 NICU nurses was utilized to examine the effects of high fidelity simulation on the knowledge acquisition, satisfaction, and self-confidence of practicing neonatal intensive care nurses. This program was centered on six critical components of neonatal care: **S**ugar and Safe Care, **T**emperature, **A**irway, **B**lood Pressure, **L**ab, and **E**motional Support (S.T.A.B.L.E.). All participants completed the

S.T.A.B.L.E. program, which made up the instructional content and a pre-test. Post-testing occurred four weeks after the course and included completion of the NLN Student Satisfaction and Self-Confidence in Learning scale to measure attitudes on self-confidence and satisfaction. Results from post-testing revealed that the mean post-test score for participants who completed the simulation exercise was higher (3.71%) than for participants who did not. Analysis indicated that the difference in mean change scores from pre- to post-test for the two groups was not statistically significant (1.71, $p = 0.489$). Results also revealed that participants with less experience had greater gains in mean post-test scores (11.40) than participants with three years of more experience (9.58). In addition, results indicated that nurses were satisfied with and confident in learning from the simulation activity. Additional analyses revealed that nursing experience and previous experience with high-fidelity simulation did not have a statistically significant effect on self-confidence in and satisfaction with learning of practicing NICU nurses. Participants were given the opportunity to share their thoughts and experiences from the course and how it was utilized in their practice. Data revealed that of the 48 study participants, over 90% made changes in bedside nursing care as a result of the material learned in the S.T.A.B.L.E. program. Overall, participants enjoyed the simulation and reported it clarified current knowledge, reinforced learning, and fostered teamwork.

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CHAPTER I

INTRODUCTION

New nurses enter the realm of professional nursing and face varying challenges upon completion of job orientation. One of the first challenges faced by these new nurses is to establish independent practice abilities. Facility orientation is provided to all new nurses but orientation to the specific clinical setting varies according to the specific nursing department. This presents new nurses with stressful situations (Delaney, 2003). Orientation to some nursing units may be longer and more comprehensive. For example, orientation to a Mother-Baby unit may require only six weeks of training while orientation to a critical care unit may require 10 weeks or more in order to provide training on situations and disease processes experienced in practice. Moreover, during orientation, it is difficult to provide new nurses with examples of all types of high-risk patient situations that may occur in practice. These situations are difficult to predict; therefore, large numbers of nurses rarely experience them during the orientation period (Decker, Sportsman, Puetz, & Billings, 2008). Thus, nurses require continued experience to expand knowledge and clinical skills (Benner, 2001).

In the end, continued competence in nursing practice remains an important concern for nurses, employers, and patients; the primary goal is the delivery of safe patient care (American Nurses Credentialing Center, 2007). In addition, the National Council of State Boards of Nursing (NCSBN; 1999) defined competence development as maintaining or refining knowledge and abilities. One method commonly used to maintain and refine knowledge is participation in continuing education. Nurses require supportive learning environments that expand on the experiences they had during orientation. Clinical educators must embrace a variety of methods and available strategies to establish supportive learning environments for continued learning. One such method is simulation. Simulation represents an approach to learning that allows participants to integrate theory and practice and experience complex problems without jeopardizing patient safety (Decker et al., 2008; Underberg, 2003). Moreover, simulation, when combined with other teaching modalities or educational activities, provides an alternate method to assess learning and skill acquisition.

Background

Simulation

According to Jeffries (2005), simulation is an activity that essentially mimics reality of patients and the clinical environment. This simulated patient-clinical environment provides an arena for practice without risk to patient safety (Decker et al., 2008). In addition, \ various types of simulators can be used to establish these practice environments. Simulation typology varies according to the complexity and fidelity involved (Decker et al., 2008). These typologies may include task trainers, computer-based programs, and human patient simulators of varying fidelity. Each type of simulator has a specific purpose in teaching and validating competencies (Peteani, 2004). Low- and medium-fidelity human patient simulators are not interactive. These simulators allow learners to perform skills and tasks and/or patient assessments. More patient assessments are capable with medium-fidelity simulators; the integration of computer technology allows replication of patient sounds that can be detected upon assessment (Decker et al., 2008).

In contrast, high-fidelity patient simulators utilize computer technology to replicate an actual patient. These simulators are interactive and utilize real environments as well as authentic equipment to mimic the patient within their respective environment (Decker et al., 2008). As high-fidelity simulators can provide feedback in the form of verbal cues and audio-video recordings, utilization of these simulators has become increasingly popular in validating competence of nursing students and as a component of continuing education. For example, nursing schools frequently use simulation to assist mastery of clinical skills in the form of skills check-offs. Students are placed in the simulated environment and instructors validate student knowledge and performance of skills using high-fidelity simulators. High-fidelity simulators are also used to create patient experiences and provide clinical days for students. Similarly, the American Heart Association (AHA; 2010) uses simulation with technical certification courses such as Pediatric Advanced Life Support (PALS) and other life saving certification courses to validate skills and knowledge. In the PALS course, a scenario-based team approach that incorporates simulation is used to teach management of pediatric emergencies involving respiratory and cardiac systems (AHA, 2010). These opportunities provide educators with various ways to assist learners in mastering complex patient skills and advance clinical knowledge.

As previously discussed, the use of high-fidelity simulation has become increasingly prevalent in academic settings. However, little research into possible outcomes of high-fidelity simulation on nursing clinical practice exists. Historically, hospital education departments have focused preparation and instruction efforts on using new technology or changes related to policy development. Ultimately, clinical educators must explore avenues of combining didactic content with clinical experience to provide effective training for new nurses as clinical knowledge and competency directly influence patient safety. These educators must provide creative strategies that assist knowledge acquisition and confidence of new nurses. The use of simulation is an objective means to provide and measure clinical knowledge and competency (Medley & Horne, 2005) within a safe learning environment.

Neonatal Intensive Care

Over the past 40 years, neonatal nursing has developed into an advanced specialty that focuses on the specialized care of neonates and infants from birth to discharge and follow-up care at home (American Nurses Association and National Association for Neonatal Nursing, 2004; Thomas, 2008). Neonatal nurses recognize and comprehend complex disease processes of newborns; these nurses strive to acquire the expertise needed to utilize advanced technology to care for infants and neonates (American Nurses Association and National Association for Neonatal Nursing, 2004). For example, currently, successful resuscitation of premature infants occurs as early as 23 weeks gestation. This was not the case 20 years ago. This advancement in resuscitation results in smaller, more critically ill neonates, requiring increased skills and knowledge from nursing staff to provide appropriate care. In addition, parents of neonates are more informed and subsequently more involved with aspects of neonatal care (Thomas, 2008). Neonatal nurses must exhibit confidence while managing complex disease processes.

Moreover, these nurses must remain aware of strategies to include parents in the care of their infants and be competent in implementing these strategies (Monterosso et al, 2005).

Patient Safety

Ultimately, this progression in technology leads to heightened awareness and concern regarding patient safety as news of medical errors abounds (American Association of Critical Care Nurses, 2002; Institute of Medicine, 2003). Hospitals and other healthcare organizations struggle with providing quality, affordable health care for patients. The Joint Commission and the Centers for Medicare & Medicaid Services (CMS; 2007) accredit many of these facilities. These agencies utilize reports on quality indicators to establish reimbursement rates for services and care rendered. CMS will not reimburse for care related to hospital-acquired complications (Centers for Medicare & Medicaid Services, 2007). For example, one quality indicator for hospitals and nursing is central line associated blood stream infections that can cost $25, 000 per episode (Centers for Disease Control, 2005). Patients with a blood stream infection will have longer hospital stays; the hospital does not receive reimbursement for the care as the infection is considered unnecessary and preventable. Nursing practice today requires inquiry into innovative methods that not only increase nursing knowledge and skill acquisition but also positively influence patient safety and/or positive patient outcomes.

Problem Identification

Ultimately, nurses require continued experience to expand knowledge and clinical skills (Benner, 2001); this expansion of knowledge and skills is one aspect of continued competence. One method used to maintain and refine knowledge and skills is participation in continuing education activities. However, there is little inquiry into creative strategies used in conjunction with continuing education activities for practicing nurses in the clinical arena. Today's healthcare arena requires knowledgeable, competent staff who can respond to ever-changing patient needs including those of high-risk infant and neonatal patients. Experiences related to these high-risk patients cannot be created on demand and the prevalence of these experiences is unpredictable. Thus, it is important to find the most effective way to assist practicing nurses maintain and enhance knowledge and skills for high-risk populations, e.g., the neonatal intensive care unit. In addition, inquiry into methods that assist nurses gain clinical knowledge and further develop their professional practice is needed.

The purpose of this study was to examine the effects on learning of adding a simulation component to an established continuing education program for neonatal nurses--The S.T.A.B.L.E.® Program (2001); this program is centered on six critical components of neonatal care: **S**ugar and Safe Care, **T**emperature, **A**irway, **B**lood Pressure, **L**ab, and **E**motional Support. It is the first national, neonatal continuing education program focused on the pre-transport and/or post-resuscitation stabilization of sick neonates and infants (Taylor & Price-Douglas, 2008). The long term goal of this study was to provide data that may be utilized for improvement of nursing education practices in the clinical setting and future research.

Research Questions and Hypotheses

This study addressed the following questions:

Q1 For nurses who participate in the S.T.A.B.L.E. program, is there a difference in mean pre-post change scores of those who complete a simulation exercise and those who do not?

Q2 For nurses who participate in the S.T.A.B.L.E. program, is there a difference in mean pre-post change scores of new and experienced nurses?

Q3 What is the effect of a simulation activity on NICU nurses' self-confidence in learning S.T.A.B.L.E. program content, based on responses on the NLN Student Satisfaction and Self-Confidence in Learning scale?

Q4 What is the effect of a simulation activity on NICU nurses' satisfaction in learning S.T.A.B.L.E. program content, based on responses on the NLN Student Satisfaction and Self-Confidence in Learning Scale?

Q5 For nurses who participate in the S.T.A.B.L.E. program, is there a relationship between demographic variables and outcome measures?

Conceptual and Operational Definitions

The following terms associated with this study must be defined:

Expertise. According to Benner (2001), expertise develops as a result of various clinical experiences over the course of time. As nurses gain experience, they progress from being able to demonstrate marginally acceptable performance to being able to demonstrate expert performance, not relying solely on analytical rules to guide behavior. These principles provided the background for the definition of expertise for this study: the ability to use previous experiences to intuitively grasp patient situations, making appropriate decisions quickly, and effectively managing change in patient presentation. For this study, nurses of all experience levels in the neonatal intensive care unit were eligible to participate in the study. Years of experience was measured by self-report on the demographic survey.

High-fidelity simulation. Jefferies (2005) defined simulation as an activity that has the ability to mimic the reality of a patient and the clinical environment. This view provided the base for the definition of high-fidelity simulation for the purposes of this study, which was a patient care scenario re-created in a controlled atmosphere utilizing an interactive mannequin that allowed nurses to practice performing specialized patient care needs commonly encountered during nursing practice in the NICU.

Knowledge acquisition and retention. Chinn and Kramer (2008) define knowledge as "awareness or perception acquired through insight, learning, or investigation expressed in a form that can be shared" (p. 299). In addition, knowledge is expressed through actions as nurses practice (Chinn & Kramer, 2008). This view of knowledge provided the background for the definition of knowledge for this study, which was the increased comprehension of facts related to managing critically ill neonates and the subsequent application of this information into nursing practice. This outcome was measured with pre- and post-testing associated with the S.T.A.B.L.E. program (2001). A change in mean pre-and post-test scores was indicative of learning. In addition, data on changes in practice were obtained from a researcher-made questionnaire completed with the post-test.

Satisfaction. For the purposes of this study, the definition of satisfaction was the definition of the concept set forth by Jeffries and Rizzolo (2006) in development of the NLN research instrument for student satisfaction and self-confidence. This research instrument utilizes a measure of how satisfied students are with different aspects of a simulation activity to classify student satisfaction. For this study, satisfaction was measured by the nurses' scores on the NLN Student Satisfaction and Self-Confidence in Learning scale.

Self-confidence. For the purposes of this study, the definition of self-confidence was the definition of the concept set forth by Jeffries and Rizzolo (2006) in development of the NLN research instrument for student satisfaction and self-confidence. This research instrument classifies self-confidence as a measure of how confident students are regarding the skills and knowledge presented on caring for patients in a select simulated experience (Jeffries & Rizzolo, 2006). For this study, self-confidence was measured by the nurses' scores on the NLN Student Satisfaction and Self-Confidence in Learning scale.

S.T.A.B.L.E. program. The National League for Nursing (NLN; 2001) defines continuing education as personal, educational experiences that support individual growth and ongoing development of knowledge and skills beyond basic nursing preparation. Various continuing education (CE) offerings are available to nurses; one such program is the S.T.A.B.L.E. program (2001). Karlsen (2003) defined the S.T.A.B.L.E. program as one that focuses on post-resuscitation and/or pre-transport stabilization. The mnemonic S.T.A.B.L.E. stands for the assessment and care modules that comprise the course: **S**ugar (blood glucose) and safe care, **T**emperature, **A**irway, **B**lood pressure, **L**ab work, and **E**motional support. For this study, the S.T.A.B.L.E. program provided the instructive portion of this study in the form of a CE activity.

Assumptions

This study assumed that all participants were Registered Nurses (RNs) with a valid state of Louisiana license to practice. It was also assumed that the study participants were fully competent NICU nurses capable of undertaking the responsibilities associated with patient care. In addition, these nurses were cognitively able to provide sound nursing judgment. Moreover, it was assumed that all participants were capable of appropriately answering the questionnaire.

Limitations

This study had noted limitations. Generalizability of the results to nurses who work in other clinical specialties was limited; this study consisted only of NICU RNs. While participants were asked not to share the details of the simulation activities, there was still a possibility that conversations of this nature occurred over the course of the study.

Significance and Potential Contribution

This study is important to the profession of nursing because it examined methods nurse educators in the clinical arena can utilize for continued education and, ultimately, to promote continued competence. In general, it is not difficult to conduct a simple skills fair for nursing staff. However, it is much more difficult to provide realistic replications of patient scenarios for nursing staff to apply specific knowledge and skills. If clinical nurse educators do not provide continuing education for practicing nurses in ways that challenge their abilities and encourage growth, then there is a possibility that these nurses may not maintain the level of mastery and expertise needed to consistently deliver safe, effective patient care.

Summary

Nursing educators in the clinical arena are increasingly challenged to use creative strategies to provide continuing education and competency validation. High-fidelity simulation represents one such creative strategy. This study examined the relationship between high-fidelity simulation and learner characteristics, knowledge acquisition and retention, and satisfaction in learning and self-confidence in learning. Findings from this study may be used to assist nurses maintain mastery of skills and knowledge needed to provide effective patient care.

CHAPTER II

REVIEW OF THE LITERATURE

This chapter presents a discussion of literature related to this study. This chapter opens with a discussion of the two frameworks used to guide this study: The Nursing Education Simulation Framework (Jeffries, 2007) and Novice to Expert Theory of Clinical Competence (Benner, 2001). Current literature and research related to simulation and formal instructional content are also presented. Discussion in this chapter also includes how this study added to the body of nursing science.

Theoretical Frameworks

The Nursing Education Simulation Framework

The Nursing Education Simulation Framework (Jeffries, 2007) encompasses five conceptual components that are operationalized through several different variables: teacher factors, student factors, educational practices incorporated into the instruction, simulation design characteristics, and expected student outcomes (see Figure 1). According to this framework, the teacher is essential to successful learning and simulations are student-centered. Teachers and students influence the overall instruction in the following aspects: demographic characteristics of the teachers as well as demographics, age, and level of students; these aspects also influence the type of activities that took place in the classroom and/or during instruction (Jeffries, 2007).

Examples of the activities that occur during instruction are active learning, collaboration, feedback, and student-faculty interaction; collectively, these activities comprise educational practices of instruction. The characteristics of teachers, students, and educational practices, as described above, influence simulation design. Important simulation design characteristics include the following: objectives: fidelity, problem solving, student support, and debriefing. Interactions of all components described influence student outcomes, which as defined by this framework include learning (knowledge), skill performance, learner satisfaction, critical thinking, and self-confidence (Jeffries, 2007).

In general, the Nursing Education Simulation Framework was applicable to this study in that it measured the impact of simulation on three of the described student outcomes of this model: knowledge, satisfaction, and self-confidence. In addition, this study incorporated active learning and feedback--key educational practices important to overall instruction and achievement of student outcomes as described by this framework.

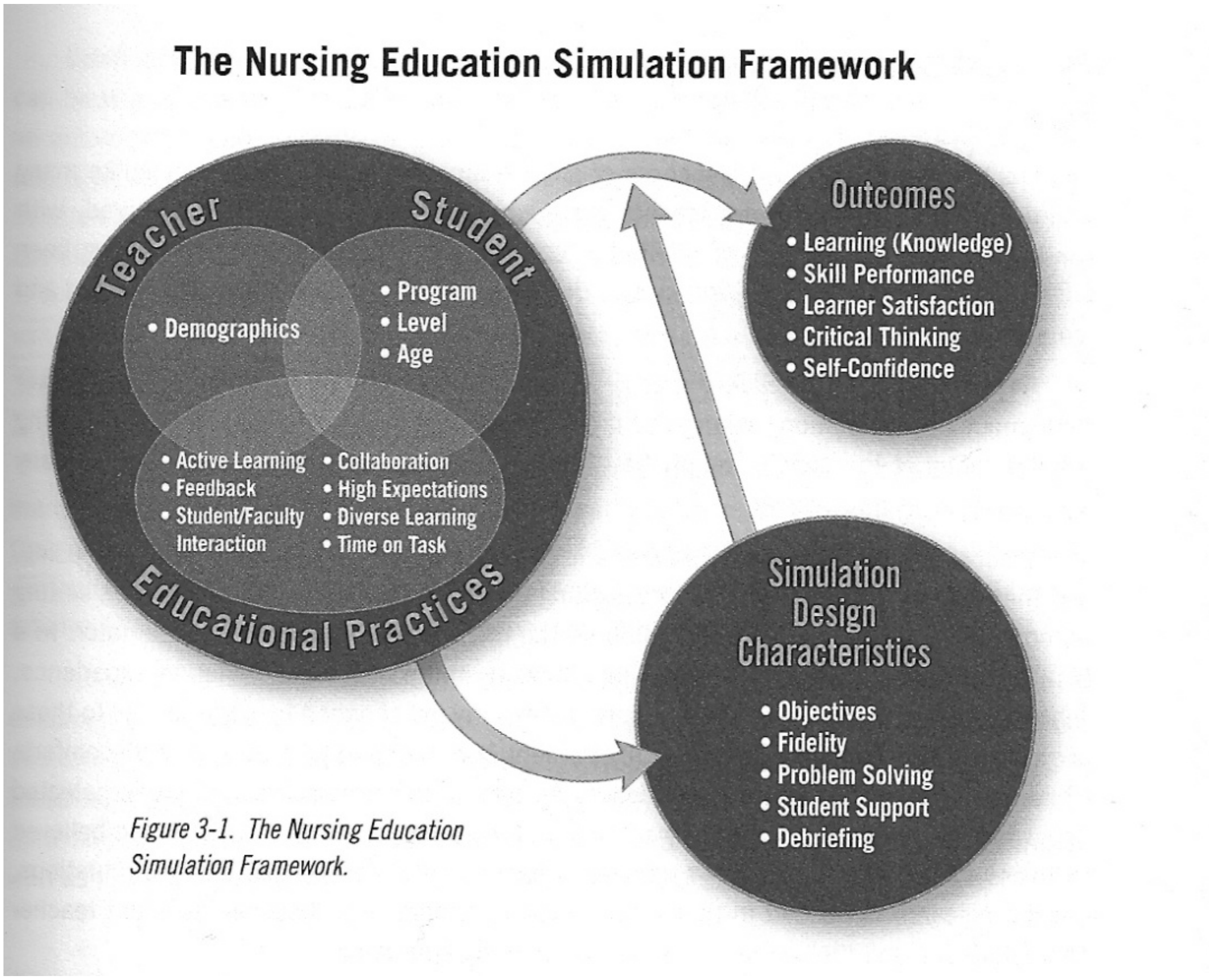

Figure 1. The Nursing Education Simulation Framework.

Note: From *Simulation in nursing education: From conceptualization to evaluation* (p. 23), edited by Jeffries, P.R. (2007), New York: National League for Nursing. Copyright 2007 by the National League of Nursing. Reproduced with permission (see Appendix A).

Novice to Expert

Benner's (2001) Novice to Expert theory of clinical competence formed the theoretical framework for this study. According to Benner, clinical knowledge is embedded in expertise—expertise that develops as clinicians test and refine hypotheses and principle-based expectations in the practice setting. Experience results when preconceived ideas are confirmed or disconfirmed by real-life situations. Therefore, experience is a prerequisite for expertise (Benner, 2001). Expertise allows nurses to interpret clinical situations; knowledge embedded within this clinical expertise is essential to the advancement of nursing practice (Benner, 2001).

In general, nurses gain clinical knowledge over time. Benner (2001) suggested that nurses pass through five levels or stages as they develop clinical knowledge and their professional practice: novice, advanced beginner, competent, proficient, and expert. Nurses with three years or more experience begin operating at the level of competence--nursing actions can be seen as long-term goals and plans (Benner, 2001). These nurses exhibit mastery of skill and the ability to cope with changes and contingencies seen in the clinical arena (Benner, 2001). As nurses continue to perform duties and skills in the same role over time, they progress from competence to proficient to expert. The expert nurse no longer relies on rules and maxims to guide behavior but rather utilizes experience to guide nursing actions (Benner, 2001). However, student nurses, new nurses, or nurses entering new areas, with new patients, are practicing as novices or advanced beginners. At the novice level, nurses have no experience on which to base their decisions. To gain the experience required for skill development, these novices are taught about clinical situations in terms of objective attributes and are given rules to guide their performance (Benner, 2001). For example, graduate nurses do not routinely participate in clinicals in neonatal intensive care settings during nursing school. These nurses are not familiar with monitoring neonatal vital signs or managing disease processes in this patient population. Moreover, these nurses must be trained how to care for this special patient population. This training begins with rules and guidelines for care since the behavior of new nurses is rules-based. Thus, these rules dictate their actions (Benner, 2001).

On the other hand, at the advanced beginner level, nurses demonstrate only marginally acceptable performance (Benner, 2001). While advanced beginners have been exposed to enough real situations to recognize certain components, these nurses are often unable to perform beyond learned behaviors and rules. For example, NICU nurses with consecutive 18-months experience are more familiar with the guidelines for practice. While these nurses may understand the need to stimulate a neonate experiencing bradycardia, they may be unable to manage these bradycardic episodes when presented with other issues during patient care. Nurses functioning at the advanced beginner level tend to treat all aspects as equally important (Benner, 2001) when faced with new situations. Most new nurses are still advanced beginners in the first two to three years of independent practice (Benner, 2001).

At the competent level, nurses generally have worked in the same position or on the same job for three years or more (Benner, 2001). These nurses see their actions and interventions in terms of plans and long-term goals rather than rote responses, and they know which aspects of the plan can change. For example, an NICU nurse with four years experience has a three-baby assignment and a plan of care to begin the shift. The nurse is able to adjust when an I.V. is found to be leaking and must be restarted. This competent nurse may lack speed but will be able to cope and manage the necessary changes. In contrast, nurses at the proficient level are able to perceive clinical situations as a whole and see meaning in terms of long-term goals (Benner, 2001). Proficient nurses use previous experiences to predict typical events and plan modified responses. As with the previous example, the proficient nurse utilizes experience to develop a plan of care that incorporates finding a leaking I.V. before beginning care and developing a plan to handle this event if it occurs. Thus, decision-making is less labored because the nurse has experience that shapes the perspective of aspects of patient care (Benner, 2001).

Finally, at the expert level, the nurse no longer requires analytical guidelines to connect understanding of a situation to an appropriate action (Benner, 2001). Expert nurses have a wealth of experience and have passed through the previous four stages of Benner's (2001) theory, which means these nurses use experience to guide actions in the clinical setting. Expert nurses demonstrate an intuitive grasp of patient situations, are able to make decisions quickly and effectively, and manage change while responding to the overall picture presented (Benner, 2001).

Ultimately, the major implication for independent practice is that nurses who are currently operating within the first two levels of Benner's (2001) theory need support in the practice setting and nurses operating in the more advanced levels of Benner's theory require the opportunity to refine current knowledge and skills. . The relevance of Benner's theory to this study was seen with the implementation of an innovative support mechanism to increase knowledge, comfort, and ultimately assist transition into expert, professional practice. This support mechanism involved utilization of an innovative teaching strategy that consisted of didactic information accompanied by simulation, which is appropriate for all levels of Benner's theory. According to Benner, nurses benefit from decision-making games and "simulations that give them practice in planning and coordinating multiple, complex patient care demands" (p. 27).

Review of the Literature

The S.T.A.B.L.E. Program

All members of the health care team must be prepared to provide timely and effective care to premature and/or critically ill infants. Care during this early transitional period impacts the immediate health of the infant as well as the infant's long-term outcome. S.T.A.B.L.E. (developed by Kris Karlsen, Ph.D, NNP-BC in 1996) is a structured program designed to meet the educational needs of health care providers who must deliver this important stabilization care (S.T.A.B.L.E. Program, 2011). S.T.A.B.L.E. stands for the six assessment/care modules covered in the program that are based on key factors associated with a higher risk of mortality in transported infants and neonates if left unaddressed: sugar and safe care, temperature, airway, blood pressure, lab work, and emotional support for families (Taylor & Price-Douglas, 2008). These modules are designed as interactive, didactic sessions that include case studies, learning activities, and evidenced-based practice on the following: providing quality patient care while eliminating preventable medical errors, monitoring and normalizing blood sugar, preventing cold stress/hypothermia, supporting ventilation, identifying and treating shock, identifying and treating infection, and providing emotional support to families in crisis. Moreover, various procedures are illustrated and explained in the program including proper placement of umbilical lines and needle chest aspiration (S.T.A.B.L.E. program, 2011; Taylor & Price-Douglas, 2008).

As the S.T.A.B.L.E. program (2011) has grown and is now provided in 45 countries around the world, researchers in these countries have examined the impact of the program on pre-transport stabilization. O'Neill and Howlett (2007) utilized a descriptive design to evaluate confidence and clinical abilities of health care providers in Nova Scotia before and after attendance in the S.T.A.B.L.E. program. There were 64 participants in of the program. Data revealed that 96% of the participants reported that the program was useful and relevant to practice, 90% reported they felt more confident in their abilities to provide pre-transport stabilization, and 86.5% reported utilization of program concepts and principles in their practice.

High-Fidelity Simulation

Patient safety remains an important concern to all health care providers. Nurses can use simulations to aid in preparations for patient situations as well as events outside of the hospital (Hovancsek et al., 2009). Simulated scenarios might also include personnel from other disciplines; this aids communication and teamwork between nursing and other healthcare professionals. Simulation experiences create opportunities for learners to develop their abilities to respond to unexpected situations; these experiences improve the competence of students as well as nurses already in practice (Hovancsek et al., 2009).

High-fidelity simulation (HFS) provides learners with an opportunity to experience high-risk situations without worry for patient safety; it provides learners with an opportunity to make mistakes and subsequently learn from those mistakes (Broussard, Myers, & Lemoine, 2009; Decker et al., 2008). High-fidelity patient simulators are realistic in appearance, interactive, and mimic physiologic parameters of patients that can be assessed: heart, lung, and bowel sounds; respirations; pulses; blood pressure; and pulse oximetry (Decker et al., 2008). This ability to provide actual patient parameters within a clinical simulation is helpful to learners as it provides opportunities to prepare for real-life clinical situations (Jeffries, Bambini, Hensel, Moorman, & Washburn, 2009) and build and refine knowledge (Benner, 2001). For example, a neonatal simulator can allow the new nurse to practice physical assessment of the neonate by recognizing normal heart and lung sounds. As knowledge and skill increase, this same neonatal simulator can be programmed with a scenario where the nurse performs a physical assessment. Then, the nurse might identify findings of heart murmurs or adventitious breath sounds and is required to respond with appropriate interventions to stabilize the patient. Thus, high-fidelity patient simulators provide versatility in learning. This versatility allows learners to hone knowledge and skill in a variety of settings.

High-fidelity simulation in academia. As HFS provides various opportunities for interactive learning that is applicable to many nursing courses and clinical arenas, use of simulated patients and environments has become more prevalent in nursing education (Jeffries, 2009; Weaver, 2011). Several studies examined the use of simulation in nursing education and student perceptions of learning after simulation experiences (Brannan, White, & Bezanson, 2008; Bremner, Aduddell, Bennett, & VanGeest, 2006; Larew, Lessans, Spunt, Foster, & Covington, 2006; Nehring & Lashley, 2004). These studies were limited to nursing academia. Bremner et al. (2006) also studied the use of simulated experiences for clinical learning. This study evaluated feelings of 56 novice students in a baccalaureate nursing program on the use of simulated clinical experiences. Data from this qualitative study indicated that students felt simulated patient experiences aided their clinical preparation. Another qualitative study performed by Larew et al. (2006) studied simulated experiences and student learning. The study goal was the development of a protocol that would support performance and learning of novice students as well as challenge advanced students. There were 190 students who participated in this study. Standardized, reproducible simulations were created in which students would identify common problems and perform appropriate interventions. The simulations challenged the students' abilities through the use of subtle cues embedded throughout the experience. Less experienced students had to be provided with more specific, detailed prompts.

Nehring and Lashley (2004) conducted an international survey on the use of human patient simulators (HPS) in nursing education. Participants from a total of 34 schools of nursing across North America, Europe, and Asia completed a 37-item survey. The survey revealed that the majority of the nursing programs utilized simulated patient experiences as part of clinical time. Student respondents reported that these simulations aided in developing critical thinking skills, applying theory in practice, and providing transition to the clinical setting. Brannan et al. (2008) compared the effectiveness of traditional classroom lecture and the interactive, human patient simulator method. This prospective, quasi-experimental, comparative design involved 107 baccalaureate nursing students. Students completed a 20-item questionnaire. Higher scores on the questionnaire were indicative of higher cognitive skills in nursing care or patients with myocardial infarction. Results revealed that students who participated in the high-fidelity simulation method achieved higher posttest scores than the group who received traditional lecture alone. There was no significant difference in confidence level.

Similarly, additional studies suggested simulated clinical experiences increased student self-efficacy, student self-confidence, and student satisfaction (Bambini, Washburn, & Perkins, 2009; Smith & Roehrs, 2009). These studies were also limited to nursing academia. Bambini et al. (2009) evaluated simulated clinical experiences as a teaching-learning strategy to increase student self-efficacy. There were 112 nursing students who participated in this integrated, quasi-experimental, repeated measures design. Survey results revealed that students experienced increased self-efficacy and increased confidence in assessment skills and providing patient education. The qualitative results revealed three key themes: increased communication, confidence, and clinical judgment. Smith and Roehrs (2009) studied the effects of simulation on satisfaction and self-confidence. This descriptive, correlational study involved 68 junior level nursing students who participated in a simulation experience as part of the medical-surgical course. The study revealed that design characteristics correlated with student self-confidence and satisfaction.

Another study by Radhakrishnan, Roche, and Cunningham (2007) examined the effects of human patient simulators on clinical performance related to safety, basic assessment skills, prioritization, problem-focused assessment, ensuing interventions, delegation, and communication. This quasi-experimental pilot study included 12 senior nursing students completing the senior clinical capstone course. The intervention group participated in two practice simulations, one hour in length, with a two-patient assignment along with clinical requirements. The study revealed that students in the intervention group achieved higher scores on outcomes safety and basic assessment skills than counterparts in the control group.

High-fidelity simulation in the clinical arena. Research about the impact of HFS in the clinical arena continues to develop. One such examination was conducted by educators and the continuing education department of the University of Louisiana at

Lafayette Department of Nursing (ULLDON; Stefanski & Rossler, 2009). A course was created specifically for the preparation of critical care nurses. This course was designed for novice and experienced nurses and incorporated patient simulated experiences with HFS. Expert clinicians and nurse educators served as course faculty. Participants completed the simulation activities daily after the corresponding lecture material. Satisfaction and self-confidence were measured with the Nurse Satisfaction and Self-Confidence in Learning tool, a modified version of the National League for Nursing's research tool, Student Satisfaction and Self-Confidence in Learning. The modification consisted of the addition of specific questions about satisfaction and self-confidence to simulated activities. Twenty-eight nurses from the surrounding community participated in the course. Researchers found that 96% of participants agreed that teaching methods utilized in the simulation were effective and all participants reported that the simulations promoted their learning as a critical care nurse. In addition, 88% of participants reported more confidence in preparation to master the content presented in the simulations.

A six-month follow-up survey yielded nine returned surveys. Eight of the nine respondents reported that the course was beneficial; they were able to apply course information and simulation activities to their practice.

Likewise, Ackermann, Kenny, and Walker (2007) developed a program in which new nurses participated in two days of simulated patient experiences. Twenty-one new nurses participated in the program, which began the second week of their orientation program. Program participants reported that they believed the use of simulation facilitated their learning. Beyea, von Reyn, and Slattery (2007) examined the effects of simulation on competency, confidence, and readiness for entry into practice of new graduate nurses in a registered nurse residency program. Forty-two nurses participated in the 12-week residency program that consisted of weekly didactic presentations and structured simulation experiences. Program content included professional development, quality improvement, collaboration, and patient safety. Scenarios were included from three different areas: medical/surgical, pediatrics/pediatric critical care, and adult critical care. Participants rated their level of confidence, competence, and readiness to provide independent nursing care weekly. Data revealed that 95% of the nurses reported they enjoyed the simulations. Participants reported that they were confident in what had been learned, that the hands-on learning experiences forced one to think through the situation presented, and that it was a great way to apply what was learned to practice.

Summary of the Literature

Study Designs

Ten studies were included in this literature review; these studies were published between 2004 and 2009. The studies selected for review utilized quasi-experimental as well as descriptive designs with sample sizes ranging from 21 to 112. Three of these studies employed quasi-experimental designs: one was an integrated, repeated measures study (Bambini et al., 2009), one was a prospective, comparative study (Brannan et al., 2008), and the last was a pilot study (Radhakrishnan et al., 2007). Two studies employed a qualitative design (Bremner et al., 2006; Larew et al., 2006). The remaining studies that were reviewed used descriptive designs (Ackermann et al., 2007; Beyea et al., 2007; Nehring & Lashley, 2004; Smith & Roehrs, 2009; Stefanski & Rossler, 2009). In five of the 10 studies, the primary researchers used convenience samples that included nursing students or nurses in orientation; the remaining study used a sampling of 34 schools of nursing. Data collected in all of the studies revealed that participants believed simulated activities resulted in the following: facilitated learning; aided clinical preparation; aided development of critical thinking skills; applying theory to practice and transitioning to the clinical setting; and increased student self-efficacy, self-confidence, and satisfaction (Ackermann et al., 2007; Bambini et al., 2009; Beyea et al., 2007; Brannan et al., 2008; Bremner et al., 2006; Larew et al., 2006; Nehring & Lashley, 2004; Radhakrishnan et al., 2007; Smith & Roehrs, 2009; Stefanski & Rossler, 2009).

Theoretical Frameworks

Three of the studies reported utilizing a theoretical framework to guide research. These three studies utilized different frameworks. Bambini et al. (2009) utilized Bandura's self-efficacy theory, Larew et al. (2006) utilized Benner's (2001) Novice to Expert, and Smith and Roehrs (2009) utilized the Nursing Education Simulation Framework (Jeffries, 2007). All three studies included discussions of study results as they related to the theory.

Results

Several studies examined the use of simulation in nursing education and student perceptions of learning after simulation experiences in the academic arena (Ackermann et al., 2007; Brannan et al., 2008; Bremner et al., 2006; Larew et al., 2006; Nehring & Lashley, 2004; Radhakrishnan et al., 2007) and the clinical setting (Ackermann et al., 2007; Beyea et al., 2007; Stefanski & Rossler, 2009). Participants reported common themes: simulated patient experiences aided clinical preparation and ability to respond to patients, facilitated learning and its application to practice, aided basic assessment skills, and yielded higher posttest scores than those who received traditional lecture alone. Brannan et al. (2008) found no significant difference in confidence level, p = 0.09.

Similarly, remaining studies suggested simulated clinical experiences increased student self-efficacy, student self-confidence, and student satisfaction (Bambini et al., 2009; Smith & Roehrs, 2009). A common theme reported by participants included increased self-confidence. Smith and Roehrs (2009) found that design characteristics correlated with student self-confidence (r_s =0.573) and satisfaction (r_s=0.614). One study (Nehring & Lashley, 2004) found that respondents reported simulations aided in developing critical thinking skills, applying theory in practice, and providing transition to the clinical setting.

Study Limitations

Two of the studies that utilized quasi-experimental designs used convenience sampling. In addition, convenience sampling was utilized for the remaining 10 studies that were either descriptive, correlational, or qualitative in nature. The majority of the subjects in samples for 5 of the 10 studies were Caucasian females. Only one study (Nehring & Lashley, 2004) utilized an international survey that encompassed various ethnic groups.

Gaps in the Literature

Ultimately, this review of the literature suggested that simulated patient experiences facilitated knowledge development, confidence, and clinical judgment of students and novice nurses. In addition, this review revealed continued growth of research in nursing education, the use of high-fidelity simulation, and a growing body of knowledge on the use of high-fidelity simulation as it relates to learning, satisfaction, and self-confidence. However, few studies examined the use of high-fidelity simulation in the clinical setting. Moreover, limited studies have been performed in the neonatal intensive care arena. Evidence-based data regarding the impact of high-fidelity simulation on professional nurses in the clinical setting, rather than nursing school clinical experiences, are lacking. This represents an area for further study. Moreover, this study would add needed information on the effectiveness of high-fidelity simulation when used for education of practicing nurses.

CHAPTER III

METHODOLOGY

This chapter provides a description of the study, information about the study design, setting, population, recruitment and sampling technique, instrumentation, and ethical considerations.

Design

This study employed a quasi-experimental, pre-test, post-test mixed design with a control group. The study examined the effects of high-fidelity simulation on the knowledge acquisition, satisfaction, and self-confidence of practicing neonatal intensive care nurses. This type of design yields reliable evidence in relation to cause and effect (Polit & Beck, 2008). Moreover, researchers have greater confidence in causal relationships elicited with this type of designs as these relationships are observed under controlled conditions (Polit & Beck, 2008).

In this study, participants first completed a pre-test and then completed instructional content that required the implementation of principles used for neonatal stabilization. Next, participants assigned to the experimental group took part in a high-fidelity simulation scenario experience while those in the control group completed the usual case study that is part of the S.T.A.B.L.E. process. Four weeks after completion of the instructional content, participants were asked to complete a post-test. The post-test was completed at this time to assess long-term learning rather than simple recall that occurs immediately following instruction. Data are available on the established validity and reliability of the National League for Nursing (NLN; 2011) Student Satisfaction and Self-Confidence in Learning Scale. Participants in this study were students of the S.T.A.B.L.E. course; thus, the original scale remained appropriate for use. Data were analyzed to determine the effects of the simulation experience on learning, satisfaction, and self-confidence. Moreover, demographic characteristics including current age, age when entered the workforce, nursing educational background, experience in nursing, and previous experience with simulation were analyzed to determine if any relationships existed between these characteristics and the outcomes.

In addition to the quantitative measures described, this study also attempted to elicit additional data from participants regarding their implementation of principles learned from the instructional content. Participants were given the opportunity to share their thoughts about and experiences with what was remembered from the course and how it was utilized in their practice. An open-ended survey was used to gather this data; participants were asked to complete this survey four weeks after completion of the instructional content at the same time as the post-test and Student Satisfaction and Self-Confidence in Learning Scale.

Setting

This study was set within a neonatal intensive care unit (NICU) of a southern hospital in the United States. This NICU is classified as a Regional-Level IIIB NICU. In addition to providing basic care for infants and neonates, Regional Level IIIB NICUs also provide comprehensive care for infants born as early as 28-weeks gestation or less and who weigh 1000 grams or less (American Academy of Pediatrics [AAP] and The

American College of Obstetricians and Gynecologists [ACOG], 2007). These NICUs are capable of providing advanced respiratory support, advanced imaging services with urgent test interpretation as needed, surgical care, and 24-hour onsite access to neonatal medical specialists and pediatric medical subspecialists (AAP/ACOG, 2007).

Target and Accessible Population

The target population for this study was neonatal intensive care nurses. The majority of NICU nurses are Registered Nurses (RNs) rather than Licensed Practical Nurses (LPNs). These RNs may enter the practice of nursing in general care or specialty populations, which include neonatal intensive care nursing, upon completion of one of the typical programs satisfying the requirements for entry into practice (either a diploma program, associate degree program, or baccalaureate degree program) and subsequent licensure. In addition, NICU RNs are predominantly female. The accessible population for this study consisted of nurses practicing in the NICU of a southern hospital who had attended and completed the S.T.A.B.L.E. program. A specified number of continuing education hours are required for re-licensure in this southern state and the S.T.A.B.L.E. program included appropriate continuing educational content. This facility had five sessions of the S.T.A.B.L.E. program scheduled and the ability to add two additional sessions if needed. Each session could accommodate 20 registrants. While continuing education activities are mandatory, the courses are not specified for these nurses. Thus, nurses were able to choose the S.T.A.B.L.E. or other programs. The program as scheduled could accommodate a total of 100 participants; this represented the available, accessible population. These nurses mirrored the target population in that they were female RNs with varying educational preparation.

The participants completed all instructional content included in the S.T.A.B.L.E. program to be included in the study. Persons who did not complete all sections of the course were excluded from the study. The simulation experience was based upon the content of the course. Participation in the study was voluntary. Due to the nature of nursing school curricula and clinical experiences, some participants might have had previous experience with simulation. The researcher was unable to control for this aspect but gathered descriptive data about it. RNs in the NICU also have varying levels of nursing experience; RNs of all experience levels were eligible to participate in the study. According to Benner (2001), new nurses, novices, and/or advanced beginners have been working in the same job for one to three years. While these new nurses might recognize recurring, meaningful aspects of patient care because of repetitive real-life situations, they are unable to view their actions as long-term goals and plans (Benner, 2001). This study utilized Benner's definition as described to delineate new nurses from experienced nurses; new nurses were defined as nurses who had been practicing less than three years. Ultimately, the researcher was unable to control for these varying levels of experience but gathered data and analyzed it to determine if there were differences that could be associated with this variable.

Sampling Procedures

This study used probability sampling to assign those who agreed to participate to experimental and control groups. A sampling interval was established where every other person was assigned to the control group with the remaining individuals assigned to the experimental group. Each group was equal in number. This method of random sampling provided an equal chance for all members of the population to be selected, resulting in samples that were representative of the population (Polit & Beck, 2008). In addition, use of probability sampling increases the external validity of a study (Polit & Beck, 2008).

This study examined whether there was a relationship between experiencing a simulation activity, where simulation was the independent variable, and knowledge development and self-confidence, the dependent variables. A power analysis for bivariate correlations was completed in an effort to assure statistical power and to predict adequate sample size. There was no prior research available on the impact of simulation on NICU nurses. Previous estimates of effect size for research similar to this study were also unavailable. Thus, a moderate effect size was assumed (d = .60) with a power of .80 and α =.05, which required a minimum sample size of 44; this minimum sample was divided into experimental and control groups. This estimate corresponded to conventional values since most nursing research studies commonly exhibit effect sizes in a range of 0.20 to 0.40 with few greater than .50 (Polit & Beck, 2008). It is acceptable to assume medium effect size when the effect is estimated to be substantial enough to be seen without the aid of research procedures (Polit & Beck, 2008).

Recruitment

Information regarding continuing education offerings is routinely sent via email to employees. Utilizing this familiar, established method, an initial letter was sent via email to all registrants of the S.T.A.B.L.E. program three weeks prior to the course. The letter provided potential participants with an explanation of the problem, the purpose of the study, potential benefits, and a contact number for the primary researcher to call with any questions they might have. It was explained that those randomized into the control group would have the option to experience the simulation exercises after the study was completed. All activities associated with the study were included in the schedule associated with the continuing education offering when registrants signed up for the course. In addition, when registrants agreed to participate in the study, they agreed to have the time available to remain for the duration of the course and all activities associated with the study. Moreover, it was made clear to all registrants that participation was voluntary, that they could withdraw from the study activities at any time but continue with the continuing education offering, and that declination to participate and scores on testing would affect employment. The Louisiana State Nurses Association (LSNA) awarded the S.T.A.B.L.E. course eight contact hours. The contact hours awarded to participants might be applied to continuing education requirements for state re-licensure and specialty re-certification.

This initial letter was accompanied by a consent form for participation. Potential participants were able to send in the consent form via mail or return it electronically. Incentives were not used to increase participation in the study. As consent forms were received, registrants were randomly assigned to experimental and control groups. Participants were not informed of their group assignment until immediately before the simulation activity began. Participants who consented to participate were asked to complete the demographic section of the questionnaire before the study. The demographic questions accompanied the initial contact letter and participants returned the questionnaire electronically or on the morning of the course. The primary researcher, who was also the educator for the unit, was present on the morning of the course for additional questions. These activities are routinely included in preparation and development of continuing education, which is a regular part of the educator’s role. The unit's nurse manager, who is also a S.T.A.B.L.E. program instructor, did not participate in recruitment nor act as a member of the research team in an effort to avoid a sense of coercion. Copies of the consent form were also available on the morning of the course for participants to sign as needed; these signatures were obtained by the research assistant prior to the start of course. All participants were asked to refrain from discussing the simulation exercises as registrants from several S.T.A.B.L.E. courses would be involved in the study.

Approximately one week prior to start of the course, registrants were sent a second email reminder about the study. Failure to reply to this email or return documents was considered a declination to participate in the study. No further mailings were sent to these registrants about the study.

Testing associated with the study occurred during normal work hours to maintain convenience for study participants. The department and parent facility routinely provided opportunities for continuing education without charge, where participants might still work required hours during the week, and schedules were adjusted to allow attendance. As a result, participants' salaries were not negatively impacted.

Control group participants wanting to experience the simulation exercises after study completion were given the opportunity to schedule the simulation scenarios within three weeks from completion of data collection. A four-hour block of time was allocated for the simulation experience, which would allow all control participants to complete the scenarios in groups of two. None of the control group participants requested to complete the simulation scenarios.

Ethical Considerations

Institutional Review Board (IRB) approval was obtained from all participating facilities prior to data collection (see Appendix E). The purpose and nature of the research study were explained to participants by a member of the research team as well as the educator, who was the primary researcher. Educator participation in continuing education and in-services, in addition to grading employee performance and maintaining confidential employee information, was a normal part of the educator role at this facility and did not represent any harm to potential participants. Moreover, the educator was not responsible for hiring or termination of employment and did not perform annual performance evaluations of RNs. Thus, there was no threat to employment. Participation was voluntary; declining to participate did not have any influence on the continuing education experiences provided or employment.

The pre- and post-tests of the S.T.A.B.L.E. program were the same tests. The researcher could not change this as this aspect was part of the program guidelines. However, questions on the pre-test appeared in random order without any indication as to the reflected module for the question. Questions on the post-test were grouped by the module for which it pertained. This arrangement of questions for the pre- and post-tests also differed visually so participants would not readily realize they were taking the same exam. In addition, it was not announced that the questions on the documents were the same. Pre- and post-test scores on the S.T.A.B.L.E. tests did not result in changes to the employee’s professional development plan on the annual performance review. In addition, the test scores remained confidential; these scores are considered part of the education file of the employee. Test scores and performance associated with in-servicing and continuing education are a normal part of the employee's education file to which the researcher had access due to her position as the unit educator; thus, it was not necessary to de-identify the data on pre-tests and post-tests. However, all tests were de-identified for data analysis. Administration guidelines for the S.T.A.B.L.E. program required reporting of pre- and post-tests for all individuals and these scores were kept confidential. Participants were randomly assigned a number that was used to label their pre- and post-tests, the demographic questionnaires, and the self-confidence and satisfaction with learning scales. This number was assigned by the researcher prior to data analysis and used to match participant data, ensuring that all the pieces were there for each participant while de-identifying study data for analysis. Participants were only required to write their names on the tests and questionnaires. All data for this study were kept in a locked file cabinet housed within the education department. Data collectors and the primary investigator were the only persons with access to the scored exams. Scored exams for the study will be kept for three years and then destroyed as part of the study protocol. Ordinarily the exams associated with continuing education would be scanned into the employee's file and then destroyed.

Data Collection

Operational Definitions

Expertise. Indirectly measured by years of experience from demographic questionnaire.

High-fidelity simulation. A neonatal patient care scenario re-created in a controlled atmosphere utilizing the SimNewB™ that allows nurses to practice performing physical assessments, delivery room management, and additional skills encountered during nursing practice.

Knowledge acquisition and retention. An increase from pre-test to post-test scores on the S.T.A.B.L.E. program's pre- and post-assessments.

Satisfaction. A score of four or greater on the satisfaction subscale of the Student Satisfaction and Self-Confidence in Learning Scale as suggested by the authors of the tool.

Self-confidence. A score of four or greater on the self-confidence subscale of the Student Satisfaction and Self-Confidence in Learning Scale as suggested by the authors of the tool.

Methods to Enhance Rigor.

Threats to validity are common in various research designs. Internal validity requires that the outcome result from the independent variable rather than extraneous variables (Polit & Beck, 2008). This internal threat is also related to participant characteristics (Polit & Beck, 2008). The researcher attempted to manage this internal threat by utilizing participants who were homogeneous--they all were neonatal intensive care nurses. However, in terms of experience, these nurses might have had variations in clinical care of NICU babies and the researcher could not control for this. Thus, an evaluation of the influence of intervening variables was conducted and correlations were performed as needed. All study participants were NICU nurses who participated in and completed all instructional content included in the S.T.A.B.L.E. program. Data analysis was performed on aspects such as nursing experience, previous experience with simulation, current age, age when upon entering the workforce, and educational level, which might have accounted for variability in the sample. Additional methods to enhance rigor included random assignment to experimental and control groups.

Instruments

Testing and instrumentation often provide threats to validity (Polit & Beck, 2008). To address this potential threat to instrument validity, testing utilized instruments from the literature with established validity and reliability. These instruments included the S.T.A.B.L.E. program Test Version 7.0, the Student Satisfaction and Self-Confidence in Learning Scale, and a demographic questionnaire.

Knowledge acquisition was measured using the S.T.A.B.L.E. program Test Version 7.0, the latest edition currently being used for pre- and post-testing. This version was developed after subsequent changes to Test Version 5.0. Reliability of Test Version 5.0 was established with a Kuder-Richardson-20 statistic: 0.90 (Karlsen, 2003). Validity of Test Version 5.0 was established from a review of 486 pre- and post-tests returned from S.T.A.B.L.E. instructors in 14 states across America and Ireland. The mean pre-test score was 79.4 and the mean post-test score was 94%, resulting in a statistically significant difference between the two scores ($p < .001$; Karlsen, 2003).

Test version 7.0 is a 40-item pre- and post-test with identical questions that measure knowledge attainment for each section of the course: nine questions on sugar/safe care, five questions on temperature, 14 questions on airway, four questions on blood pressure, three questions on labs, and five questions on a mixed module that includes emotional support. Validity was established by content review by 38 clinical experts who were comprised of RNs, advanced practice RNs, and physicians. Recent reliability testing was not available but is expected to be comparable to Test Version 5.0 (S.T.A.B.L.E. Program, 2011)

Permission to use the Student Satisfaction and Self-Confidence in Learning Scale was obtained from the National League for Nursing (2011; see Appendix B). The Student Satisfaction and Self-Confidence in Learning Scale is a 13-item instrument that is designed to measure satisfaction with the simulation activity and self-confidence in learning. Five items in a sub-scale address satisfaction with the simulation experience and the remaining eight items in a sub-scale address self-confidence in learning, all on a five-point scale. Content validity of the instrument was established by nine clinical experts. Cronbach's alpha was used to determine reliability: reliability for satisfaction was 0.94 and reliability for self-confidence was 0.87.

A two-part, researcher-developed, NICU/STABLE Study Questionnaire was utilized to measure demographics and self-report data on experiences from participants (see Appendix C). Content validity of the questionnaire was established by five content experts. Demographic characteristics were measured using Part A of the questionnaire: age, race/ethnicity, educational attainment, NICU experience, and experience as an RN. S.T.A.B.L.E. program principles were measured using Part B of the questionnaire that included questions about participants' experiences since completing instructional content, which generated qualitative data for analysis. These questions were related to how participants used the information gained from the S.T.A.B.L.E. course and/or simulation exercises in their practice in the four weeks after completing the course.

Preparation for Data Collection
Procedure

The primary researcher and research assistants are certified lead instructors for the S.T.A.B.L.E. Program. Instructor status is required to teach course content; this status was obtained by attendance and completion of a national two-day conference where course content and program guidelines were reviewed. In addition, all instructors must score at least 70% on pre-testing and at least 85% on post-testing. Additional training to provide S.T.A.B.L.E. content is not required.

The S.T.A.B.L.E. Program is a course that is purchased by facilities wishing to implement the program. Permission to teach the course is not required. However, since this study utilized content and tools of the program, collaboration with and permission to use the pre- and post-tests, data, and scenarios for the study was obtained from the program developer/founder, Dr. Kris Karlsen.

Simulation activity. The primary researcher provided a one-hour training session for the research assistants on the remaining instruments to be used in the study. Only the data collectors were present during the training session--the primary researcher and research assistants. This training session occurred two weeks prior to the beginning of the course and data collection and encompassed the purpose of the instruments involved in the study, the content covered by each, how to administer the tools along with the post-test, and appropriate scoring. The training session also included training on the S.T.A.B.L.E. program simulation exercises. The scenarios utilized for the simulation exercise were provided by Dr. Karlsen and those scenarios were not altered for this study. The primary researcher and research assistants, who are S.T.A.B.L.E. instructors, are also members of the core team for the department who were trained to run the SimNewB™

neonatal simulator. The primary researcher and research assistants received training on the SimNewB™ neonatal simulator by a Laerdal® training specialist. The training consisted of an eight-hour education day that covered the following material: setting up the simulator, programming default settings, running scenarios through the laptop as well as the remote, and general trouble-shooting. The SimNewB™ neonatal simulator is consistently used by all members of the research team throughout the year to maintain knowledge and skills related to the technology.

The primary researcher was present at each S.T.A.B.L.E. course offering that was part of the study and accompanying simulation sessions to facilitate consistency. Members of the research team ran the scenarios, observed, took notes, and coordinated the debriefing sessions. The simulation scenario consisted of a premature infant born to a diabetic mother. The infant was hypoglycemic and participants had to demonstrate appropriate assessment and intervention according to content learned in the S.T.A.B.L.E. course (see Appendix D for a general description of simulation scenario and associated equipment).

Data collection. Data collection for this study was performed through pre- and post-testing. Pretesting consisted of completion of the S.T.A.B.L.E. pre-assessment Test Version 7.0 and Part A of the NICU/STABLE Study Questionnaire (demographics), which were both completed via pen and paper two weeks before the course began (see Table 1). Participants brought both of these documents to the reserved classroom where the course took place. The pre-assessments were completed prior to giving out course documents and manuals. Data collectors gathered and scored all tests. Scored tests remained secure in a locked file cabinet in the education department; the data collectors were the only persons with access to the tests. Participants and members of the research team were the only persons allowed in the classroom during testing.

Post-testing involved completion of the Student Satisfaction and Self-Confidence in Learning Scale, the S.T.A.B.L.E. post-assessment Version 7.0, and completion of Part B of the NICU/STABLE Study Questionnaire (Application). These documents were completed via pen and paper. Pre-test scores were shared with participants. Post-testing commenced four weeks after completion of the instructional content and simulation activity. A day was designated as post-testing day and participants were able to come in at their leisure during a four-hour block of time to complete all post-testing and surveys. Participants were given 45 minutes to complete and turn in the tests. A dedicated classroom was utilized for testing; the same data collection and management standards identified for pretesting applied for post-testing. In an effort to accommodate participants unable to come in for testing, post-tests, the Student Satisfaction and Self-Confidence in Learning Scale, and the experiences, parts of the questionnaire were emailed to participants four weeks after completion of the course. Participants had seven days to complete and return the documents. A reminder to complete the documents was sent to all participants who had not turned in the documents on day eight. Data collectors graded tests and kept them secure in a locked file cabinet within the education department until the data analysis phase began.

Table 1

Data Collection Procedures

Control Group	Experimental Group
Pre-test	Pre-test
NICU/STABLE Study Questionnaire, part A (Demographics)	NICU/STABLE Study Questionnaire, part A (Demographics)
Instructional content	Instructional Content
Complex case study review	Complex case study review
	Simulation activity
Post-test 4 weeks after completion of course	Post-test 4 weeks after completion of course
NICU/STABLE Study Questionnaire, Part B (Application)	NICU/STABLE Study Questionnaire, Part B (Application)
	Questions about simulation
Simulation activity if desired	Student Satisfaction and Self-Confidence in Learning Scale

Data Analysis

Statistical analysis procedures entailed computer calculations using the Statistical Package for the Social Sciences Data Analysis Systems (SPSS) version 17.0 for Windows. SPSS is a comprehensive collection of programs that can manage and analyze large amounts of data (Gall, Gall, & Borg, 2007). The primary researcher completed coding, data entry, and data analysis. Data were entered into a Microsoft® spreadsheet and data from this spreadsheet were entered into SPSS. Specific data analysis was conducted for each hypothesis. Descriptive and correlational statistics were used to analyze demographic characteristics; descriptive statistics communicate information about the associated sample and assist the researcher in presenting a representation of the participants (Polit & Beck, 2008). The characteristics that were analyzed included current age, age upon entering the workforce, race/ethnicity, educational attainment, previous experience with high-fidelity simulation, NICU experience, and experience as an RN. Current age, age upon entering the workforce, race/ethnicity, experience, and level of educational attainment are nominal data; thus, these characteristics were reported as frequencies and percentages. Descriptive statistics were also employed to answer each hypothesis as appropriate.

Inferential statistics were used to test the hypotheses and analyze the dependent variables as inferential statistics provide an avenue for estimating parameters and drawing conclusions about data (Polit & Beck, 2008).

Q1 For nurses who participate in the S.T.A.B.L.E. program, is there a difference in mean pre-post change scores of those who complete a simulation exercise and those who do not?

The pre and post-tests for the S.T.A.B.L.E. program were utilized to collect data on knowledge acquisition and retention--one of the dependent variables in the study. Pretest and posttest mean scores were calculated for the S.T.A.B.L.E. tests; this allowed comparison of these two scores to determine if they changed. The mean also provided a representation of average performance on the exam (Gall et al., 2007).

In addition, an analysis of variance (ANOVA) was performed to determine whether there was a difference in pre- to post-test scores between the experimental and control groups. This method is a parametric test that compares the means of two different samples and determines if these means differ significantly (Gall et al., 2007; Polit & Beck, 2008).

> Q2 For nurses who participate in the S.T.A.B.L.E. program, is there a difference in mean pre-post change scores of new and experienced nurses?

Descriptive statistics were used to answer this question. Mean change scores and standard deviations for each group were calculated. Because these nurses formed two unequal groups with varying experience levels, a Mann-Whitney U was performed to analyze these differences. The Mann-Whitney U is a non-parametric test used to compare means when assumptions of normality are not met (Gall et al., 2007).

> Q3 What is the effect of a simulation activity on NICU nurses' self-confidence in learning S.T.A.B.L.E. program content, based on responses on the NLN Student Satisfaction and Self-Confidence in Learning scale?

The Student Satisfaction and Self-Confidence in Learning Scale was utilized to collect data on self-confidence--the second dependent variable in the study. Self-confidence was measured on a 5-point Likert subscale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Descriptive statistics were also used to answer this question. Overall means of the self-confidence score and associated standard deviations were calculated to ascertain how self-confident nurses were upon completion of the program. In addition, a Mann-Whitney U was conducted to compare mean scores for self-confidence in learning of new and experienced nurses. The Mann-Whitney U is a non-parametric test used comparing the means of two unequal groups (Gall et al., 2007). Further analysis utilizing the Mann-Whitney U was conducted to compare mean scores for self-confidence in learning of new and experienced nurses as well as nurses who had previous experience with simulation and those who did not.

> Q4 What is the effect of a simulation activity on NICU nurses' satisfaction in learning S.T.A.B.L.E. program content, based on responses on the NLN Student Satisfaction and Self-Confidence in Learning Scale?

The Student Satisfaction and Self-Confidence in Learning Scale was also utilized to collect data on satisfaction--the third dependent variable in the study. Satisfaction was measured on a 5-point Likert subscale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Descriptive statistics were used to answer this question. Overall mean satisfaction scores and standard deviations were calculated to ascertain how satisfied nurses were with the simulation activity. The difference in the two group means was analyzed utilizing Mann-Whitney U, a non-parametric test used to compare means of a sample when groups are unequal (Gall et al., 2007). Further analysis utilizing the Mann-Whitney U was conducted to compare mean scores on satisfaction with learning of new and experienced nurses as well as nurses who had previous experience with simulation and those who did not.

> Q5 For nurses who participate in the S.T.A.B.L.E. program, is there a relationship between demographic variables and outcome measures?

The Pearson's product-moment correlation coefficient was utilized to analyze whether correlations existed between the demographic characteristics (current age, age when entered workforce as RN, ethnicity, experience as RN, highest degree in nursing, and previous experience with simulation) and the variables of satisfaction and self-confidence (Polit & Beck, 2008).

Additional Findings

An item analysis for pre- and post-tests was performed and compared for both the experimental and control groups. In addition, a *t*-test was performed to analyze the difference between experimental and control groups for passing the 85% benchmark on post-tests as required by the S.T.A.B.L.E. program. Descriptive statistics were also used to answer this question. Mean scores and standard deviations for each group were calculated. Further analysis was conducted utilizing the independent samples *t*-test to analyze the difference in changes made to bedside care between the experimental and control groups.

The additional qualitative data elicited from participants were analyzed using Creswell's (2007) approach to transcription analysis. Data were reviewed several times and important phrases related to the phenomena of study were identified. Next, meanings were formulated from these phrases and clustered into themes. This clustering of meanings into themes allowed identification and emergence of common themes from the data. In an effort to establish consensus on the identification of relevant themes, the primary researcher and research assistants reviewed all data, formulated phrases, and themes.

Summary

Ultimately, the learning experience of new nurses continues after nursing school. Nursing educators in the clinical setting must explore various strategies that support growth and knowledge of new nurses while protecting patient safety. Simulation represents an innovative method to expose nurses to complex patient scenarios without jeopardizing patient safety. The use of simulation has gained popularity but data on the effectiveness of this strategy are needed. Research into the possible effects of simulation would provide data educators could use for future planning of nursing education practices in the clinical setting.

CHAPTER IV

RESULTS

The purpose of this study was to examine the effects on learning by adding a simulation component to an established continuing education program for neonatal nurses, The S.T.A.B.L.E. ® Program, a national, neonatal continuing education program focused on the pre-transport and/or post-resuscitation stabilization of sick neonates and infants (Taylor & Price-Douglas, 2008). A pre-test was taken before content presentation began. Half of the participants then went through a simulation exercise after the standard class while the control group completed the usual case study. A post-test was taken by all participants four weeks after the class. Those in the simulation group also completed the National League for Nursing (NLN; 2011) Student Satisfaction and Self-Confidence in Learning Scale and some questions about their experience. Analyses were conducted to examine mean pre-test, post-test, and change scores and to determine whether there were differences between the simulation and control groups. Further analysis was conducted to determine overall mean satisfaction and self-confidence after the simulation learning experience as well as any relationship between the demographic variables and outcome measures. This chapter presents a description of the demographics of the sample used in the study and the results of the analyses conducted in order to address the research questions for this study.

Characteristics of the Sample

The accessible population for this study consisted of practicing RNs in the NICU of a southern hospital who attended and completed the S.T.A.B.L.E. program. This was the first time the S.T.A.B.L.E. program was offered at the institution and RNs of all experience levels were allowed to participate. There were 60 RNs enrolled in the course; however, four nurses declined to participate in the study and eight did not attend the in-service as scheduled, resulting in a final sample of 48 participants.

In this study, NICU experience of participants varied: 16.7% (n = 8) had up to five years experience, 29.2% (n = 14) had 6 to 12 years experience, 33.3% (n = 16) had 13 to 20 years experience, and 20.8% (n = 10) had 21 or more years of experience as a NICU nurse. As is typical of the region and the hospital, the majority of the participants were Caucasian (98%) falling between the ages of 41 to 50 (33.3%) and having 13 to 20 years (33.3%) experience as a NICU nurse. Of the 48 participants, 46 (98%) reported previous experience with high-fidelity simulation. For those reporting previous experience with high-fidelity simulation, 77.1% (n = 37) reported one to two previous experiences within the past year focused on skills assessment and competency. Table 2 provides an overall description of the demographics of the study participants.

A multivariate analysis of variance was conducted on the demographic variables outlined in Table 2 to examine equivalence of the simulation and control groups and to determine whether statistical methods were appropriate for use in this study. Parametric tests were used for data analysis since no differences reached the .05 level of significance.

Table 4

Sample Characteristics

Characteristics	Response Options	Frequency	Percent
Ethnicity	African-American	1	2.1
	Caucasian	47	97.9
	Total	48	100.0
Current Age	20 to 30 years	8	16.7
	31 to 40 years	13	27.1
	41 to 50 years	16	33.3
	51 to 60 years	10	20.8
	61 years or older	1	2.1
	Total	48	100.0
Age Upon Entering Workforce as an RN	20 to 30 years	37	77.1
	31 to 40 years	11	22.9
	Total	48	100.0
Years Worked as a NICU Nurse	0 to 5 years	8	16.7
	6 to 12 years	14	29.2
	13 to 20 years	16	33.3
	21 years or more	10	20.8
	Total	48	100.0
Hours Worked Per Week as a NICU Nurse	Less than 20 hours	1	2.1
	21 to 30 hours	3	6.25
	31 to 40 hours	3	6.25
	41 hours or more	41	85.4
	Total	48	100.0
Highest Degree Held (In Nursing)	Diploma	6	12.5
	Associates	18	37.5
	Baccalaureate	22	45.8
	Masters	2	4.2
	Total	48	100.0
Previous Experience with High-Fidelity Simulation	None	2	4.1
	1 to 2	37	77.1
	3 to 4	6	12.5
	5 or more	3	6.3
	Total	48	100.0
Type of Experience with High-Fidelity Simulation	Drills	5	10.4
	Orientation	3	6.3
	Skills Day	40	83.3
	Total	48	100.0

Data Analysis

Prior to analyzing data, all entries were reviewed for typographical errors such as transposed numbers or incorrectly entered data. These errors were corrected prior to analyzing research data using SPSS® 17.0. Data were also reviewed for outliers, e.g., extremely low pre-test scores. Initially, pre-tests scores appeared to be much lower than the majority of participants' scores with one score of 55. Participants' scores were verified and graphed. The distribution presented as a normal curve. As this participant's score was exposed to the same conditions as other participants, it was not removed from the data set (Gall et al., 2007).

Reliability Measurements

An alpha level of 0.05 was used for all statistical tests; only tests that resulted in *p* values less than 0.05 were reported as statistically significant. Reliability testing was performed on the study test results. A Kuder-Richardson-20 statistic calculated on the S.T.A.B.L.E. Program 5th edition test, version 7.0 that was used in this study was found to be 0.90. This was consistent with the 0.90 obtained by Karlsen (2003) with previous reliability testing on S.T.A.B.L.E. program exams.

A Cronbach's alpha coefficient was also calculated on both subscales of the NLN (2011) Student Satisfaction and Self-Confidence in Learning Scale. In general, tests with a score of 0.80 or higher prove to be reliable for most research processes (Gall et al., 2007). The Cronbach's alpha for this study sample was found to be 0.91 for the satisfaction subscale and 0.87 for the self-confidence subscale. This was similar to the scores of 0.94 for satisfaction and 0.87 for self-confidence obtained and reported by NLN when the scales were developed.

In addition, item analysis was conducted on the S.T.A.B.L.E. pre- and post-tests--the same tests with the same questions. However, test appearance and questions were changed: questions on the pre-test were presented randomly without any indication as to which content module the question related; questions on the post-test were grouped by the corresponding module. Both the pre- and post-tests covered the six modules included in the S.T.A.B.L.E. program: sugar, temperature, airway, blood pressure, lab, and emotional support. During test analysis by the S.T.A.B.L.E. program, it was found that items 18 and 38 were among those frequently answered incorrectly. These questions pertained to blood pressure and lab work respectively; 48% answered item 18 incorrectly and 47% answered item 38 incorrectly (A. Kendall, personal communication, February 10, 2012). Similar results were achieved with this study sample; however, percentages of participants answering the items incorrectly were higher. The most frequently missed question was the question pertaining to lab work: 69% (n = 33) answered the item incorrectly. The second most frequently missed question was the question on blood pressure with 54% (n = 26) answering the item incorrectly. During post-testing for the study sample, item analysis revealed better performance on these two questions; 17 participants (35%) answered the item pertaining to lab work incorrectly, resulting in an improvement of 34%, and 19 participants (40%) answered the item pertaining to lab work incorrectly, resulting in an improvement of 14%.

Results

Data analysis was conducted specifically for each research question. The following describes the results for each.

Q1 For nurses who participate in the S.T.A.B.L.E. program, is there a difference in mean pre- post change scores of those who complete a simulation exercise and those who do not?

Descriptive and inferential statistics were utilized to answer this question that refers to knowledge acquisition and retention. The mean pre-test score for participants in the experimental group was 77.54 (SD = 7.599). The mean post-test score for this group was 87.96 (SD = 6.471), resulting in a mean difference in scores of 10.42. The mean pre-test score for participants in the control group was 75.54 (SD = 8.027). The mean post-test score was 84.25 (SD = 5.907), resulting in a mean difference in control group scores of 8.71. Results for each group are reported in Table 3.

Three analyses of variance (ANOVAs) were performed to analyze the differences between the experimental and control groups. There was a small difference between the groups on the mean scores for the pre-test (2.0, p = 0.380, not significant) and the post-test (3.71, p = 0.044), which was found to be statistically significant. The change in scores from pre- to post-test for participants who completed a simulation activity was slightly higher (10.42) than for participants who did not (8.71). This difference was not found to be statistically significant (p = 0.489) as shown in Table 4.

Table 3

Pre- and Post-Test Scores and Change Scores

Group	Pre-Test Scores	Post-Test Scores	Difference from Pre- to Post Tests (Change scores)
Control			
Mean	75.54	84.25	9.12
N	24	24	24
Std. Deviation	8.027	5.907	6.490
Minimum	55	73	0
Maximum	90	95	23
Experimental			
Mean	77.54	87.96	10.42
N	24	24	24
Std. Deviation	7.599	6.471	6.338
Minimum	65	78	0
Maximum	95	98	25
Differences between groups	2.00	3.71	1.71

Table 4

Differences in Test Scores between Experimental and Control Groups

	df	Mean Square	F	Sig.
Pre-Test Scores				
Between Groups	1	48.000	0.786	0.380
Within Groups	46	61.085		
Post-Test Scores				
Between Groups	1	165.021	4.300	0.044
Within Groups	46	38.380		
Difference in Pre to Post Tests				
Between Groups	1	20.021	0.487	0.489
Within Groups	46	41.140		

Q2 For nurses who participate in the S.T.A.B.L.E. program, is there a difference in mean pre- post change scores of new and experienced nurses?

Descriptive statistics were utilized to answer this question. Mean change scores and standard deviations were calculated for each group. The mean pre-test score for participants with less than three years experience was 74.20 (*SD* = 5.805) and the mean post-test score was 85.60 (*SD* = 2.236), an increase of 11.40. The mean pre-test score for participants with three years or more experience was 76.81 (*SD* = 8.007) and the mean post-test score for this group was 86.16, an increase of 9.58. Table 5 shows pre- and post-test statistics by years of experience.

Table 5

Pre-Post Test Scores and Differences by Experience

Group	Pre-Test Scores	Post-Test Scores	Difference in Post-Pre Tests
Less than 3 years			
Mean	74.20	85.60	11.40
N	5	5	5
Std. Deviation	5.805	2.608	3.782
Minimum	68	83	7
Maximum	83	90	17
3 years or more			
Mean	76.81	86.16	9.58
N	43	43	43
Std. Deviation	8.007	6.729	6.620
Minimum	55	73	0
Maximum	95	98	25
Differences between groups	2.61	0.56	-2.05

Because participants in this study formed two primary groups with varying experience levels (new and experienced), inferential statistics were also utilized to ascertain whether there were significant differences in change scores between these two groups. A Mann-Whitney U was performed to analyze these differences. The Mann-Whitney U is a non-parametric test used to compare means when assumptions of normality are not met (Gall et al., 2007) as was the case with the number of new (n = 5) and experienced (n = 43) nurses who comprised the study. The difference in change scores from pre- to post-test for participants with less than three years experience (11.40) was higher than for participants with three or more years experience (9.58). This difference was not found to be statistically significant (p = 0.341).

Q3 What is the effect of a simulation activity on NICU nurses' self-confidence in learning S.T.A.B.L.E. program content, based on responses on the NLN Student Satisfaction and Self-Confidence in Learning scale?

This question was answered by utilizing descriptive statistics to analyze participant responses on the Self-Confidence subscale of the Student Satisfaction and Self-Confidence in Learning Scale. Participants' scores for the self-confidence subscale ranged from 2-5 on a 5-point Likert subscale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The overall mean score was 4.33 (SD = 0.688). The score indicated that after completion of the simulation activity, nurses felt confident to very confident in their learning; 68% of the participants scored within 0.67 points of the mean. Table 6 shows the overall descriptive information for self-confidence.

Two items of the subscale specifically focused on nursing practice and were examined in more detail since clinical practice was the setting for this study: assessing participants' attitudes on mastery of content of simulation activity and development of knowledge and skills for the clinical setting from the simulation activity. When looking at these two items, there was not a large degree of variation in the scores from the average for the scale. This small degree of variation implied reliability in the test items. Moreover, the participants' scores were close to the middle of the data set, indicating that participants' attitudes were consistently confident to very confident in mastery of content and development of knowledge and skills from the simulation activity.

Table 6

Descriptive Statistics for Self-Confidence in Learning

Scale Content	Minimum	Maximum	Mean	Std. Deviation
Mastery of Simulation Content	3	5	4.25	.608
Critical Content	3	5	4.38	.576
Development of Skills and Knowledge from Simulation	3	5	4.38	.576
Use of Resources	3	5	4.38	.647
Student Responsibility	4	5	4.62	.495
Obtaining Assistance	4	5	4.62	.495
Utilization of Activities	4	5	4.50	.511
Instructor Responsibility	2	5	3.96	1.042

Participants in the study sample were of varying levels of clinical experience, ranging from newer to more experienced nurses. The effect, if any, of this varied experience level on self-confidence in learning was unknown. Therefore, further analysis utilizing a Mann-Whitney U was conducted to compare mean scores for self-confidence in learning of new and experienced nurses. The Mann-Whitney U is a nonparametric test used to compare means when assumptions of normality are not met (Gall et al., 2007) as was the case with the number of new (n = 3) and experienced (n = 21) nurses who comprised the experimental group for this study. With regard to mastery of simulation content, self-confidence subscale scores of nurses with less than three years experience ranged from 4 to 5 with a mean of 4.33 (SD = 0.577). The scores for nurses with three years experience or more ranged from 3 to 5 with a mean of 4.24 (SD = 0.625), resulting in a difference of 0.09 with the less experienced nurses scoring slightly higher. There was no statistical difference between these two groups (p = 0.842). With regard to development of required knowledge and skills, the self-confidence subscale of nurses with less than three years experience ranged from 4 to 5 with a mean of 4.33 (SD = 0.577). The scores for nurses with three years experience or more ranged from 3 to 5 with a mean of 4.38 (SD = 0.590), resulting in a difference of 0.08 with the more experienced nurses scoring slightly higher. There was no statistical difference between these two groups (p = 0.842).

The majority of the study participants in the simulation group had previous experience with high-fidelity simulation. With regard to mastery of content, the subscale score mean of nurses without previous experience with simulation (n = 1) was 5.00 (SD = 0). The subscale scores for nurses with previous experience (n = 23) in simulation ranged from 3 to 5 with a mean of 4.22 (*SD* = 0.600), resulting in a difference of 0.78; the nurses without previous experience with simulation scored slightly higher. Because there was only one nurse without previous experience with simulation, no further analysis was conducted. With regard to development of required knowledge and skills, the subscale score for nurses without previous experience was 5.00 (*SD* = 0). The subscale scores for nurses with previous experience with simulation ranged from 3 to 5 with a mean of 4.35 (*SD* = 0.573), resulting in a difference of 0.65; the nurses without previous experience with simulation scored slightly higher. Because there was only one nurse without previous experience with simulation, no further analysis was conducted.

Q4 What is the effect of a simulation activity on NICU nurses' satisfaction in learning S.T.A.B.L.E. program content, based on responses on the NLN Student Satisfaction and Self-Confidence in Learning Scale?

This question was answered by utilizing descriptive statistics to analyze participant responses on the Satisfaction subscale of the Student Satisfaction and Self-Confidence in Learning Scale. Participants' scores for the satisfaction subscale ranged from 2 to 5. The overall mean score was 4.25 (*SD* = .721), which indicated that nurses were satisfied to very satisfied with learning from the simulation activity. Table 7 shows the results for items on the satisfaction subscale.

As participants in the study sample had varying clinical experience levels, further analysis utilizing the Mann-Whitney U was conducted to compare mean scores on satisfaction with learning of new and experienced nurses. The Mann-Whitney U is appropriate for comparing means for unequal groups as was the case with the number of new (*n* = 3) and experienced (*n* = 21) nurses. Satisfaction subscale scores of nurses with less than three years experience ranged from 4 to 5 with a mean of 4.33 (*SD* = .577). For nurses with three years experience or more, satisfaction subscale scores ranged from 2 to 5 with a mean of 4.41 (*SD* = .698), resulting in a difference of 0.08. This difference was not found to be statistically significant (*p* = 0.729).

Table 7

Descriptive Statistics for Satisfaction

Scale Content	Minimum	Maximum	Mean	Std. Deviation
Methods Helpful	3	5	4.42	.584
Learning Materials	2	5	4.29	.806
Enjoyed Simulation	2	5	4.46	.721
Motivation	3	5	4.42	.584
Suitability	2	5	4.29	.806

As previously mentioned, the majority of the study participants had previous experience with high-fidelity simulation. For the nurse without previous experience with simulation, the satisfaction subscale mean score was 5.00 (*SD* = 0). For nurses with previous experience with simulation (*n* = 23), satisfaction subscale scores ranged from 2 to 5 with a mean score of 4.36 (*SD* = 0.676), resulting in a difference of 0.64 with the nurse without previous experience in simulation scoring slightly higher. Because there was only one nurse without previous experience with simulation, no further analysis was conducted.

Q5 For nurses who participate in the S.T.A.B.L.E. program, is there a relationship between demographic variables and outcome measures?

As study variables may have a degree of linear relationship between them, the Pearson's product-moment correlation coefficient was utilized to analyze whether correlations existed between demographic characteristics (current age, age when entered workforce as RN, ethnicity, experience as RN, highest degree in nursing, and previous experience with simulation) and the dependent variables of satisfaction and self-confidence (Polit & Beck, 2008). No significant correlations were found between these aforementioned demographic characteristics and the variables of knowledge acquisition and retention, self-confidence, and satisfaction ($p < 0.05$). A Pearson's product-moment correlation coefficient was also performed to analyze whether correlations existed between the demographics characteristics (current age, age when entered workforce as RN, ethnicity, experience as RN, highest degree in nursing, and previous experience with simulation), knowledge acquisition and retention, and pre- to post-test change scores. No significant correlations were found with change scores, knowledge acquisition and retention, and aforementioned demographic characteristics (< 0.05).

Additional Findings

Quantitative Findings

Another way to analyze knowledge retention between groups in this study was to examine the data for meeting the 85% benchmark required by the S.T.A.B.L.E. program. Study findings revealed that 67% ($n = 16$) of participants in the simulation group met the benchmark the first time the post-test was completed. The remaining 33% ($n = 8$) had to repeat incorrect items on the post-test to meet the benchmark. In the control group, 46% ($n = 11$) of participants met the benchmark the first time the post-test was completed; the remaining 54% ($n = 13$) had to repeat incorrect items on the post-test to get a score of 85%. An independent *t*-test was performed and showed that the difference was significant ($p = 0.04$) as reported in Table 8. In addition, pre-test scores varied; nurses who met the benchmark the first time the post-test was completed did not always have higher pre-test scores (63-85). While definite conclusions could not be drawn from this data, it suggested that participation in the simulation activity might aid knowledge retention.

Table 8

First Post-Test Statistics

Levene's Test for Equality of Variance		*t*-test for Equality of Means			
F= 0.184	Sig.= 0.670	df	Sig. (2-tailed)	Mean Difference (Std. Error Difference)	95% Confidence Interval (upper)
		46	0.044	3.708 (1.788)	0.109 (7.308)

In addition to benchmark data, study participants in the experimental group were asked to provide information on their perceptions of the simulation activity utilizing a 4-point Likert scale with a range of 1 to 4. Participants were asked to report on whether they liked the simulation format ($M = 3.50$, $SD = 0.509$), whether they could incorporate the information learned into their practice (M = 3.50, $SD = 0.509$), and whether they believed the simulation was a valuable way to practice events encountered in the NICU (*M* = 3.61, *SD* = 0.497). Table 9 reports the findings for the experimental group.

Table 9

Descriptive Statistics on Perceptions of Simulation Activity

Perception/Belief	Frequency	Valid Percent
Liked Format of Simulation Scenario		
Strongly Agree	12	50.0
Agree	12	50.0
Disagree	0	0.0
Strongly Disagree	0	0.0
Total	24	100.0
Can Incorporate Information into		
Practice	12	50.0
Strongly Agree	12	50.0
Agree	0	0.0
Disagree	0	0.0
Strongly Disagree	24	100.0
Total		
Believe Simulation is a Valuable Way to		
Practice Events Encountered in the		
NICU	14	58.4
Strongly Agree	10	41.6
Agree	0	0.0
Disagree	0	0.0
Strongly Disagree	24	100.0
Total		

Participants were asked to report on changes made to bedside nursing care since completion of the S.T.A.B.L.E. program. These changes included the following: whether participants thought about the program while assessing NICU patients, whether they remembered aspects of the S.T.A.B.L.E. program while communicating with physicians, whether they remembered aspects of the S.T.A.B.L.E. program while communicating with other nurses, and whether they had changed one or more aspects of their nursing care as a result of the material they learned during the course. Data revealed that of the 48 study participants, changes in bedside nursing care were as follows: 98% of participants (n = 46) thought about aspects of the program while assessing NICU patients, 94% of participants (n = 45) remembered aspects of the program during communications with other nurses, 87.5% (n = 42) remembered aspects of the program during communications with physicians, and 90% of participants (n = 43) changed at least one aspect of their nursing care as a result of the material learned in the S.T.A.B.L.E. program. With regard to nursing care in relation to the S.T.A.B.L.E. program, 75% of participants (n = 36) reported that they made changes in bedside care related to sugar (recognition of risk factors for hypoglycemia and the appropriate management of hypoglycemia) aspects.

Further analysis was conducted utilizing the independent samples *t*-test to analyze the difference in changes made to bedside care between the experimental and control groups. While there were differences between the two groups, the differences were not found to be statistically significant (p = 0.369).

Qualitative Findings

Creswell's (2007) approach to transcription analysis was utilized to review qualitative data elicited from participants who provided more information about research questions on self confidence and satisfaction with learning with simulation. With this approach, narrative data were reviewed several times, important phrases related to the phenomena of study were identified, and meanings were formulated from these phrases.

Finally, data were clustered into themes. Significant phrases were extracted from the data; Table 10 reports samples of key significant phrases regarding the use of simulation with their associated meanings. Clustering ideas yielded two domains and three themes. The two domains identified were patient care and simulation. The three themes identified were hands-on patient care/parent teaching, simulation beneficial to performance and teamwork, and knowledge clarification.

Table 10

Significant Phrases About Simulation

Significant Phrase	Domain	Theme (Associated Meaning)
"Just to treat the simulation as you would an actual event…take in all of the factors present, evaluate, and implement actions. Follow-up with evaluation, just as we do in everyday practice."	Simulation	Simulation Beneficial to Performance (Simulation reinforces practice)
"Clarified information in my knowledge base and supported knowledge I already had."	Patient Care	Knowledge Clarification (Simulation reinforces learning)
"I believe the simulations are an easy, non-threatening way to practice different events so that all staff will be ready before they occur."	Simulation	Hands On Patient-Care (Simulation increases comfort and allows practice and preparation for specific situations)
"I really like the simulation…helps focus on the big picture, management, rather than just oh my IV is out."	Simulation	Hands On Patient-Care (Simulation aids patient management)

Theme one: Hands-on patient care/parent teaching. All participants reported examples of enhanced practice as a result of completing the S.T.A.B.L.E. program combined with a simulation activity by describing scenarios of improved recognition of hypoglycemia and thermoregulation. Several participants reported that the simulation reinforced the “importance of getting the glucose before other procedures,” “importance of not forgetting the basics, e.g., a bad IV,” and using activities from the class and the simulation to explain the “management of hypoglycemia to parents of an LGA, hypoglycemic baby.” In addition, the simulation reinforced the importance of obtaining and responding to lab work in a timely manner. One participant reported that she was “daily more aware of the ‘little things’ like how long the isolette door is open and the effect it has on the baby’s temp and thereby stability.” Another participant reported how she used what was learned to instruct parents in a bonding room about the importance of thermoregulation and how this related to the infant’s temperature and feeding. After instructing the parents on “hypothermia, brown fat metabolism and convection heat loss, the parents warmed the room, and the infant’s temperature increased and feeding improved.”

Theme two: Simulation beneficial to performance and teamwork. Many participants reported that the simulation increased their comfort level with several aspects of patient care, namely responding to an event and working together as a team. One nurse commented that what she enjoyed and remembered most about the simulation was that “it went very smoothly…all nurses took their roles seriously and we learned a great deal.” Another commented on how everyone worked together and “felt very positive about the experience and about our own performances.”

Theme three: Knowledge clarification. In general, participants reported satisfaction with the simulation activity, citing how it reminded them of key principles they often took for granted because they had a tendency to respond to them singularly rather than as a part of the entire patient presentation. One nurse commented that it "made me more aware of everything." Another nurse reported that "it [the course and simulation] increased awareness of all modules." Many participants reported that the simulation activity allowed them to "remember key aspects" and "put all of the pieces together when providing care."

Summary

This chapter presented the characteristics of the study sample (n = 48); the results of tests for differences between pre-test, post-test and change scores; the results of the NLN Student Satisfaction and Self-Confidence in Learning Scale; and data about how NICU nurses felt about their participation in an educational event that included a simulation activity. Analysis indicated that the difference in mean change scores from pre- to post-test for the two groups was not statistically significant (1.71, $p = 0.489$) even though the difference in mean post-test score was found to be statistically significant (3.71, $p = 0.044$). There was a small difference between the groups on the mean scores for the pre-test, which was not found to be significant (2.0, $p = 0.380$). In addition, there was no significant difference between simulation and control groups on self-confidence in and satisfaction with learning. Additional analyses revealed that nursing experience and previous experience with high-fidelity simulation did not have a statistically significant effect on self-confidence in and satisfaction with learning of practicing NICU nurses. Correlational studies did not demonstrate statistically significant relationships between demographic characteristics and the study variables of knowledge acquisition and retention, self-confidence, and satisfaction. Moreover, analysis revealed that nurses thought about content of the S.T.A.B.L.E. program when assessing patients and communicating with members of the healthcare team but the differences for change in practices among experimental and control group participants were not statistically significant ($p > 0.369$). Analysis of perceptions of simulation by experimental group participants revealed that nurses enjoyed the simulation and considered it a valuable way to practice patient events that commonly occur in the NICU.

Responses to open-ended questions revealed that nurses thought that simulation clarified current knowledge, reinforced learning, and fostered teamwork. Moreover, simulation provided a non-threatening method to practice different events that occur when caring for patients. Overall, participants felt positively about their simulation experience.

CHAPTER V

SUMMARY AND DISCUSSION

This chapter provides a discussion of the results of this study including observations, theoretical implications, and recommendations. Implications for nursing practice are also presented including recommendations for future research.

Statement of the Problem

Ultimately, nurses require continued experience to expand knowledge and clinical skills (Benner, 2001); this expansion of knowledge and skills is one aspect of continued competence. One method that might be used to maintain and refine knowledge and skills is participation in continuing education activities and subsequent application of new information to nursing practice. However, there is little inquiry into creative strategies used in conjunction with continuing education activities for practicing nurses in the clinical arena. Today's healthcare arena requires knowledgeable, competent staff who can respond to ever-changing patient needs including high-risk infant and neonatal patients. Experiences related to these high-risk patients cannot be created on demand and the prevalence of these experiences is unpredictable. Thus, it is important to find the most effective way to assist practicing nurses maintain and enhance knowledge and skills for high-risk populations such as newborns in the neonatal intensive care unit. In addition, inquiry into methods that assist nurses gain clinical knowledge and further develop their professional practice is needed.

The purpose of this study was to examine the effects on learning by adding a simulation component to an established continuing education program for neonatal nurses--The S.T.A.B.L.E. ® Program. This program is the first national neonatal continuing education program focused on the pre-transport and/or post-resuscitation stabilization of sick neonates and infants (Taylor & Price-Douglas, 2008). This program is centered on six critical components of neonatal care: sugar and safe care, temperature, airway, blood pressure, lab, and emotional support. The long term goal of this study was to provide data that might be utilized for improvement of nursing education practices in the clinical setting and future research.

Review of the Methodology

This study employed a quasi-experimental, pre-test, post-test mixed design with a control group to examine the effects of high-fidelity simulation on the knowledge acquisition and retention, satisfaction in learning, and self-confidence in learning of practicing neonatal intensive care nurses. The sample consisted of 48 NICU nurses in a southern hospital. All participants completed the S.T.A.B.L.E. program instructional content, a pre-test, and the demographic questionnaire. Those nurses who consented to participate in the study were assigned through random sampling to either the experimental or control group. After class, nurses assigned to the experimental group participated in a simulation activity that was based on the S.T.A.B.L.E. educational content while the others completed the usual case study. Post testing for both groups occurred four weeks after the course along with completion of the National League for Nursing Student Satisfaction and Self-Confidence in Learning Scale (2011) and the NICU/STABLE Study Questionnaire. Qualitative data including thoughts and experiences and application of program content were also collected from simulation group participants regarding their implementation of principles learned from the instructional content. Descriptive and inferential statistics were utilized to analyze quantitative data.

Summary of the Results

> Q1 For nurses who participate in the S.T.A.B.L.E. program, is there a difference in mean pre-post change scores of those who complete a simulation exercise and those who do not?

The difference in pre-test scores between groups was not statistically significant. The difference in post-test scores between groups was statistically significant ($p = 0.044$). The change scores within groups were not statistically significant.

> Q2 For nurses who participate in the S.T.A.B.L.E. program, is there a difference in mean pre-post change scores of new and experienced nurses?

There was a difference in mean pre-post change scores of new and experienced nurses but the difference was not found to be statistically significant.

> Q3 What is the self-reported effect of a simulation activity on NICU nurses' self-confidence in learning S.T.A.B.L.E. program content, based on responses on the NLN Student Satisfaction and Self-Confidence in Learning Scale?

Results of the study revealed that after completion of the simulation activity, nurses felt confident to very confident in their learning (mean score = 4.33, $SD = 0.688$). When mean scores for self-confidence in learning were compared for new and experienced nurses, the difference between the two groups was not found to be statistically significant.

> Q4 How satisfied in learning are NICU nurses enrolled in the S.T.A.B.L.E. program with a simulation activity, based on responses on the NLN Student Satisfaction and Self-Confidence in Learning Scale?

Results of the study indicated that nurses were satisfied to very satisfied with learning from the simulation activity (mean score = 4.25, *SD* = 0.721). Mean scores for satisfaction with learning were compared for new and experienced nurses; while there was a difference between these two groups, it was not found to be statistically significant.

Q5 For nurses who participate in the S.T.A.B.L.E. program, is there a relationship between demographic variables and outcome measures?

There were no statistically significant correlations between the demographic characteristics and the variables of self-confidence and satisfaction.

Additional Findings

Quantitative Findings

Study findings revealed that 67% ($n = 16$) of participants in the simulation group met the 85% passing benchmark the first time the post-test was completed compared to 46% ($n = 11$) of participants for the control group ($p < 0.05$). This implied that participation in simulation activities might aid knowledge retention.

Data from the Experience Questionnaire revealed that all participants in the experimental group liked the format of the simulation scenario and believed the information learned from the activity could be incorporated into practice. In addition, 58.4% of the participants ($n = 14$) believed the simulation was a valuable way to practice events encountered in the NICU.

Data from the Experience Questionnaire revealed that of the 48 study participants, nearly all thought about aspects of the program while assessing NICU patients and remembered aspects of the program during communications with other nurses. Most nurses remembered aspects of the program during communications with physicians, changed at least one aspect of their nursing care as a result of the material learned in the

S.T.A.B.L.E. program, and changed bedside care related to neonatal blood sugar. Differences between experimental and control groups in changes made to bedside care were not found to be statistically significant.

Qualitative Findings

In addition to data on knowledge acquisition, self-confidence, and satisfaction, study results elicited qualitative findings on nurses' perceptions of simulation. When analyzing data, two domains were identified: patient care and simulation. Three themes were identified: hands-on patient care/parent teaching, simulation beneficial to performance and teamwork, and knowledge clarification. The data revealed that nurses enjoyed the simulation activity and felt it enhanced teamwork. Participants stated that the simulation activity "clarified information in my knowledge base and supported knowledge I already had," and the simulation was "an easy, non-threatening way to practice different events so that all staff will be ready before they occur." In addition, study participants reported satisfaction with and self-confidence in learning when a simulation activity accompanied the learning content.

Discussion of the Results

Interpretation of the Findings

Learning, self-confidence and satisfaction. Although the findings of this study reflected individual gains in knowledge and application of that knowledge to practice after nurses participated in the STABLE program, the small difference between the experimental and control groups was not sufficient to provide strong evidence in support of the view that simulation, when combined with lecture, had a direct, measureable impact on learning. Traditional teaching strategies such as the S.T.A.B.L.E. program lectures do foster learning; the experimental group did have a larger percentage of nurses who reached the benchmark score for the post-test on their initial attempt. Methods such as the simulation activity utilized in this study were theorized to actively involve participants in the learning process, thus allowing them to reflect upon theory as well as practice associated skills. As found in this study, the combination of theory and practice engendered feelings of self-confidence in abilities when providing complex patient care and overall satisfaction with learning. These study findings were similar to previous research with high-fidelity simulation in both academia and the clinical arena. Brannan et al. (2008) compared the effectiveness of traditional lecture and simulation and found that students who participated in a high-fidelity simulation exercise achieved higher post-test scores than those who received traditional lecture alone. Bremner et al. (2006) also studied the use of simulated experiences for learning; results from this qualitative study indicated that students felt simulated patient experiences aided their clinical preparation. Similarly, in the clinical arena, Ackermann et al. (2007) developed a program where new nurses participated in simulated patient experiences and found that participants reported simulation facilitated their learning.

Knowledge acquisition. Pre-test scores for study participants were slightly higher than average scores recorded for nurses from 2010 who also completed Test Version 7.0. The mean pre-test scores for nurses who participated in the simulation group (77.54) were slightly higher than the mean pre-test scores for nurses who did not (75.54). The mean pre-test score for nurses completing Test Version 7.0 was 73.3 (A. Kendall, personal communication, February 10, 2012). It should be noted that there was a difference in the timing and administration of the pre-test. The pre-test for study participants was given before participants received the course content and materials. Participants were not allowed to complete the test with any assistance from peers. In contrast, the pre-test for the S.T.A.B.L.E. program was not given before participants received course materials and the national process allows peer collaboration. Thus, the S.T.A.B.L.E. program pre-test was a measure of peer-supported knowledge while the pre-test data from the study reflected individual knowledge at the time of test administration. Definitive conclusions could not be made about these data. Participants' attitudes towards the exam must also be taken into consideration. Perhaps the study participants approached the pre-test differently, took the test seriously and tried to perform well, or perhaps the higher pre-test scores indicated that the study nurses had a higher level of individual knowledge at the start of the study than did the national group.

As the study results revealed, the mean post-test score for nurses who participated in the simulation group (87.96) was higher than the mean score for those who did not (84.25). The mean post-test score for nurses completing Test Version 7.0 was 94.4 (S.T.A.B.L.E. Program, 2011). This was higher than the mean post-test score achieved by all study participants (86.10). This difference might be related to the timing of the post-tests. The post-test for study participants was completed four weeks after the course. In contrast, the post-test for the S.T.A.B.L.E. program was completed the day of class in one of two ways: in sections as the content for each module was completed or at the end of the day upon completion of all course content. The S.T.A.B.L.E. cumulative post-test data were thus a measure of short-term knowledge acquisition while the post-test data from the present study reflected acquisition and retention of knowledge.

Statistical comparison of the study post-test data and the national data was not done since these differences made the groups unequal.

Results of the study revealed that the mean post-test score for the participants who completed the simulation exercise was 1.71% higher than the mean post-test score for the control group (not significant). However, the study revealed that two-thirds of participants in the simulation group met the 85% passing benchmark the first time the post-test was completed compared to the 46% of participants for the control group (p = 0.044). This finding implied that participation in simulation activities might aid knowledge retention. Overall, the post-test scores for participants were not as high as expected. The difference in meeting the passing benchmark between the two groups might be the result of the teaching method utilized for the experimental group, which was lecture combined with a simulation exercise. Simulation activities allow participants to reflect upon theory and apply what was learned using hands-on behaviors. With regard to learning, students retain less information from passive teaching methods with lecture being as little as 5%. On the other hand, retention increases when instruction includes more participatory methods, the opportunity to practice having as much as 75% of information retained (National Training Laboratories, 2012). Although the control group completed a case study, the active simulation scenario might have supported better retention of new knowledge.

Study results also revealed that less experienced nurses had greater gains in post-test scores than did the more experienced nurses, although not a significant increase. The fact that the two groups did not differ significantly on this measurement reflecting knowledge acquisition and retention might be due to their experience level; even the nurses with less than three years experience could be classified as competent or higher on Benner's (2001) scale as outlined in Chapter II. Competent nurses saw their actions in terms of plans rather than rote responses. According to Benner, decision-making is less labored at this stage because the nurse already has some experience that shaped their perspective of certain aspects of patient care. In terms of theoretical implications, these results supported tenets identified in the Nursing Education Simulation Framework (Jeffries, 2007) as presented in Figure 1; key educational practices, namely active learning and feedback, influence student outcomes including learning (knowledge), skill performance, learner satisfaction, and self-confidence.

Satisfaction and self-confidence. In addition, this study examined nurses' perceptions of the effect of simulation on self-confidence and satisfaction. Study results indicated that nurses enjoyed participating in simulation exercises; these exercises promoted positive feelings of satisfaction and self-confidence in learning and, ultimately, confidence in their nursing abilities in specific situations. Additional studies (Bambini et al., 2009; Smith & Roehrs, 2009) on simulation suggested that simulated clinical experiences increased self-efficacy, satisfaction, and self-confidence of students. The study by Smith and Roehrs (2009) utilized the National League for Nursing (NLN; 2011) Student Satisfaction and Self-Confidence in Learning Scale as did this study; mean satisfaction and self-confidence in learning scores were 4.5 and 4.2, respectively. These scores are comparable to scores obtained in this study, which were 4.3 and 4.3, respectively. Likewise, Stefanski and Rossler (2009) studied the effect of high-fidelity simulation when combined with a preparatory course designed for critical care nurses.

These nurses reported that the simulations promoted learning and confidence in preparation.

Additional analysis revealed that differences in levels of self-confidence and satisfaction in learning did not differ significantly regardless of the nurses' clinical experience levels and previous experience with simulation. Self-confidence scores of newer nurses ranged from 4 to 5 with a mean of 4.33 (SD = 0.577). The scores for experienced nurses ranged from 3 to 5 with a mean of 4.38 (SD = 0.590). The standard deviations for both groups revealed that approximately 68% of participants' scores were within 0.6 points of the mean. While there was a moderate range in reported satisfaction levels of newer (range of 3 to 5, mean of 4.33, SD = 5.77) and experienced nurses (range of 2 to 5, mean 4.41, SD = 0.698), the difference was statistically insignificant. Again, the standard deviation signified that approximately 68% of the participants' scores were within 0.6 of the mean. The fact that this difference was not statistically significant might stem from the study design. This study was designed to elicit self-reported perceptions of self-confidence and satisfaction in learning rather than actual measurements of these outcomes pre- and post-simulation. Moreover, while participants were asked not to share details of the simulation activity with others, it is possible that this sharing occurred. Foreknowledge of simulation events as well as anecdotal comments from peers might have lessened the impact of the overall experience. Likewise, participants with previous experience with simulation might have had preconceived ideas about simulation that were not met by this study, leading to less satisfaction.

This study also examined nurses' overall perceptions of simulation. Experimental group participants liked the format of the simulation scenario and believed the information learned from the activity could be incorporated into practice. In addition, the majority of the participants (58.4%) believed the simulation activity was a valuable way to practice events encountered during patient care in the NICU. As previously discussed, methods such as simulation were theorized to actively involve participants in the learning process, which allowed participants to reflect upon and perform skills rather than depend upon lecture alone. This might have assisted participants in recognizing practical knowledge gained, thus promoting satisfaction in learning.

Qualitative Results

An unexpected revelation of this study pertained to teamwork. Qualitative results revealed that participants felt the simulation allowed them to become more comfortable working together as a team. This aspect might have resulted from the fact that during the simulation, nurses were able to observe their peers, team members, in performance of their respective roles. This close visualization allowed everyone involved to become aware of how their coordinated efforts impacted the situation and, thus, the patient. In addition, qualitative results revealed that the simulation activity reinforced the importance of obtaining and responding to lab work and instructing parents on important aspects of care such as thermoregulation. This aspect might have resulted from the fact that the simulation activity incorporated responses that mimicked patient responses for these aspects. This allowed participants to reflect upon the problem, interact with the patient, and plan appropriate nursing management. Thus, the simulation combined cognitive with psychomotor skills.

Finally, participants reported that the simulation activity made them remember key principles of patient care often taken for granted as they had a tendency to respond to these issues singularly rather than as a part of the entire patient presentation.

Implications for Practice

The results of this study suggested that nurses' knowledge and practice benefited from continuing education classes and that participation in simulation was a positive learning experience for most nurses. The findings supported the results of earlier researchers who stated that simulations provided an alternative approach to learning that allowed nurses to integrate theory and practice (Decker et al., 2008; Underberg, 2003). The differences in pre-test and post-test mean scores also have implications for practice. The results revealed two significant differences with modest practical significance in relation to learning; the data seemed to support theoretical beliefs about active learning and simulation. When methods such as simulation accompanied lecture, nurses were more engaged in the learning process, citing satisfaction with and self-confidence in learning. Simulation with lecture might also better prepare nurses to perform in patient situations that often occur in practice, rather than lecture alone, as evidenced by the comments offered by participants on the overall simulation experience. The results of this study are important to clinical educators as they provide insight into alternate methods to maintain and refine the knowledge of practicing nurses. Maintenance and refinement of knowledge is a part of continued competence in nursing practice, which is essential to the delivery of effective and safe patient care. It should be noted that the difference between experimental and control groups in mean change scores was small though significant (about 2% on the exams) and thus has little practical significance. A larger difference would provide strong support for the inclusion of simulation in continuing education for practicing nurses and help justify the expense and manpower needed when simulation is used.

Suggestions for Additional Research

Although this study's findings supported tenets of established theoretical frameworks and the results were similar to previous research in the field, limitations were present. One such limitation was the small sample size. Each offering of the S.T.A.B.L.E. program utilized for this study had an average of 10 participants; this average size is comparable to average class sizes achieved nationally (A. Kendall, personal communication, February 10, 2012). However, 100% participation of the available population was not achieved. This directly related to the nature of continuing education programs in the clinical arena. The course was not mandatory and several nurses did not show up for the course although they were enrolled. This is commonly seen; nurses frequently choose to report to the unit to assist staffing and receive possible overtime pay rather than attend educational courses. In addition, this study was performed at one southern facility with a homogenous group of NICU nurses. Replication of this study with a larger sample size and varying NICUs enrolled in the S.T.A.B.L.E. program across the state might prove beneficial. This would provide results more generalizable for nurses across the region. It would be important to consider the timing and processes for taking the pre-tests and post-tests if comparison to national cumulative data is a goal of future studies.

Similarly, additional studies that test the use of simulation with hospital orientation and preparation for nursing practice would be beneficial. This would provide results that could help educators refine practices that prepare new nurses for professional practice. Moreover, additional studies that measure self-confidence and satisfaction with learning levels pre- and post-simulation would be beneficial as these results would add to the body of knowledge related to practicing nurses.

Summary

This study supported previous findings about the use of simulation in relation to knowledge acquisition and retention, self-confidence in learning, and satisfaction with learning. The results of the study indicated that nurses enjoyed participating in simulation exercises, that these exercises promoted positive feelings of satisfaction and self-confidence in learning, and that these findings supported tenets of the Nursing Education Simulation Framework and Benner's Novice to Expert theory of clinical practice. A significant difference in mean pre-post change scores for the experimental and control groups was not observed but there was a significant difference between the groups on mean post-test scores. In addition, a significantly higher percentage of nurses in the simulation group met the benchmark score for post-testing on their first attempt.

Overall, high-fidelity simulation is proving to be a positive teaching strategy that can be used with other traditional methods of teaching. As this research evidence expands, clinical educators may embrace this technology with more confidence in order to provide supportive learning environments for nurses to maintain and refine knowledge for the provision of safe patient care.

APPENDIX A

PERMISSION TO REPRINT NATIONAL LEAGUE OF NURSING SIMULATION FRAMEWORK

May 9, 2011

Nicole Decuir Square, MSN, RNC-NIC-BC
University of Northern Colorado
Greeley, CO

Dear Ms. Square:
Thank you for your email requesting permission to use the Simulation Framework in your dissertation proposal entitled *High-Fidelity Simulation in Nursing Practice: The Impact on Nurses' Knowledge Acquisition, Satisfaction, and Self-Confidence*. I am pleased to give you permission for the following:

> "The Nursing Education Simulation Framework," developed as part of the 2003-2006 NLN/Laerdal Simulation Study and most recently revised and published on page 23 in the work noted below, may be used within your dissertation proposal.
>
> > Jeffries, P.R. (2007). <u>Simulation in nursing education: From conceptualization to evaluation</u>. New York: National League for Nursing.

In granting permission to use this Framework, it is understood that the following assumptions operate and "caveats" will be respected:

- ✓ The Framework will be used only for the purpose outlined above.
- ✓ The Framework will be included in its entirety and not modified in any way.
- ✓ The report of your research will acknowledge that the Framework has been included with the permission of the National League for Nursing, New York, NY.
- ✓ The National League for Nursing is the sole owner of these rights being granted.
- ✓ No fees are being charged for this permission.

I am pleased that material published by the National League for Nursing is seen as valuable to your research, and I am pleased that we are able to grant permission for its use. Should you have any questions, please feel free to contact me directly.

Respectfully,

Linda Christensen
Chief Administrative Officer
National League for Nursing
lchristensen@nln.org

APPENDIX B

PERMISSION TO USE NATIONAL LEAGUE OF NURSING STUDENT SATISFACTION AND SELF-CONFIDENCE IN LEARNING TOOL

It is my pleasure to grant you permission to use the “Educational Practices Questionnaire,” “Simulation Design Scale” and “Student Satisfaction and Self-Confidence in Learning” NLN/Laerdal Research Tools. In granting permission to use the instruments, it is understood that the following assumptions operate and "caveats" will be respected:

1. It is the sole responsibility of (you) the researcher to determine whether the NLN questionnaire is appropriate to her or his particular study.
2. Modifications to a survey may affect the reliability and/or validity of results. Any modifications made to a survey are the sole responsibility of the researcher.
3. When published or printed, any research findings produced using an NLN survey must be properly cited as specified in the Instrument Request Form. If the content of the NLN survey was modified in any way, this must also be clearly indicated in the text, footnotes and endnotes of all materials where findings are published or printed.

I am pleased that material developed by the National League for Nursing is seen as valuable as you evaluate ways to enhance learning, and I am pleased that we are able to grant permission for use of the “Educational Practices Questionnaire,” “Simulation Design Scale” and “Student Satisfaction and Self-Confidence in Learning” instruments.

Nasreen Ferdous | Grant Assistant | National League for Nursing | www.nln.org
nferdous@nln.org | Phone: 212-812-0315 | Fax: 212-812-0391 | 61 Broadway | New York, NY 10006

APPENDIX C

RESEARCHER DEVELOPED QUESTIONNAIRE

NICU/STABLE STUDY QUESTIONNAIRE

Please respond honestly. Participation is voluntary, and your responses will remain confidential. It is not necessary to include your name on this questionnaire. It takes approximately 5 minutes to complete this questionnaire.

PART A—Demographics

Directions: Please circle the appropriate answer.

1. How long have you worked as a NICU nurse?
   A. 0 to 5 years
   B. 6 to 12 years
   C. 13 to 20 years
   D. 21 years or more

2. Over the past year, how many hours per week did you work as a NICU nurse?
   A. Less than 20 hours
   B. 21 to 30 hours
   C. 31 to 40 hours
   D. 41 hours or more

3. What is your current job title?
   A. Staff Nurse
   B. Nurse Manager
   C. Other.
      Please specify other roles you participate in such as transport RN and/or preceptor. ____

4. Have you had previous experience with high-fidelity mannequin simulation prior to participating in this study? If so, how many?
   A. 1 – 2 experiences
   B. 3 – 4 experiences
   C. 5 or more experiences
      If yes, please describe the situations in which you experienced and/or participated in simulation using a high-fidelity mannequin: NRP, skills check-off, unit orientation, other.

      ____

      ____

      ____

      ____

5. What is your ethnicity?
   A. African-American
   B. Caucasian
   C. Hispanic
   D. Asian
   E. Other

6. What is your current age ?
   A. 20 to 30 years
   B. 31 to 40 years
   C. 41 to 50 years
   D. 51 to 60 years
   E. 61 years and over

7. What was your age upon entering the workforce as a registered nurse?
   A. 20 to 30 years
   B. 31 to 40 years
   C. 41 to 50 years
   D. 51 years and over

8. What is your nursing educational preparation (highest degree earned in nursing)?
   A. Diploma
   B. Associate Degree in Nursing
   C. Baccalaureate Degree in Nursing
   D. Masters Degree in Nursing
   E. Other (please specify) ______________________________________

   ____

NICU/STABLE STUDY QUESTIONNAIRE

Please respond honestly. Participation is voluntary, and your responses will remain confidential. It is not necessary to include your name on this questionnaire. It takes approximately 5 minutes to complete this questionnaire.

PART B—Application of the S.T.A.B.L.E. Program

Directions: Please circle the appropriate answer.

1. When did you complete the S.T.A.B.L.E. course?
   A. July 2011
   B. August 2011
   C. October 2011
   D. November 2011
   E. December 2011
   F. January 2012

2. Which research group did you participate in?
   A. S.T.A.B.L.E. course only
   B. S.T.A.B.L.E. course with high-fidelity mannequin simulation
   C. Control group with later simulation experience that was offered

Now that you have completed the S.T.A.B.L.E. course, please comment on the following items as they pertain to your bedside patient care:

3. I find myself thinking about aspects of the Program while assessing my NICU or transitional care patients
   A. Strongly Agree
   B. Agree
   C. Disagree
   D. Strongly Disagree

4. I find myself remembering aspects of the Program while communicating with other nurses
   A. Strongly Agree
   B. Agree
   C. Disagree
   D. Strongly Disagree

5. I find myself remembering aspects of the Program while communicating with medical staff providers
   A. Strongly Agree
   B. Agree
   C. Disagree
   D. Strongly Disagree

6. I have changed 1 or more aspects of my nursing care as a result of the material I learned in the S.T.A.B.L.E Program
   A. Strongly Agree
   B. Agree
   C. Disagree
   D. Strongly Disagree

7. Those aspects of nursing care I have changed include the following: (Circle all that apply)
   A. Sugar— recognition of risk factors for hypoglycemia and the appropriate management of hypoglycemia
   B. Temperature—recognition of risk factors associated with hypothermia, recognition of cold stress, and the appropriate management of hypothermia
   C. Airway--assessment of respiratory distress, recognition of respiratory failure, and management of respiratory illness.
   D. Blood pressure--assessment of hypovolemic, cardiogenic, and septic shock and the appropriate management of shock (hypovolemic, cardiogenic, and/or septic)
   E. Lab work—recognition of risk factors associated with infection and the appropriate management of sepsis
   F. Emotional Support—recognition of families in crisis and appropriate methods to facilitate parenting

8. If you have incorporated contents of the S.T.A.B.L.E. course into your professional practice, please provide an example of enhanced practice you provided that sticks in your mind or that you think was an important change.
   ____
   ____
   ____
   ____

Additional comments: ____
____
____
____
____

The remaining questions are for those who participated in the simulation scenario. If you did not complete the scenario, you may stop here.

9. I liked the format of the simulation scenario.
   A. Strongly Agree
   B. Agree
   C. Disagree
   D. Strongly Disagree

10. I can incorporate the information I learned into my nursing practice
    A. Strongly Agree
    B. Agree
    C. Disagree
    D. Strongly Disagree

11. I think this is a valuable way to practice events that I may encounter in the NICU
    A. Strongly Agree
    B. Agree
    C. Disagree
    D. Strongly Disagree

12. What do you remember most about the simulations? ____________________

    ____

    ____

    ____

    ____

APPENDIX D

DESCRIPTION OF SIMULATION EQUIPMENT AND SCENARIOS

Description of Simulation Equipment and Scenarios

Scenario: Preterm Infant with recurrent, symptomatic hypoglycemia; respiratory distress with probable pneumonia; hypotension (pre-subgaleal hemorrhage)
Discipline: NICU
Expected Simulation Run Time: 20 to 30 minutes

History:
A 36-4/7 week gestation LGA infant delivered vaginally after spontaneous rupture of membranes. The mother had gestational diabetes and received appropriate prenatal care.
APGAR scores 6 and 8 at 1 and 5 minutes, temperature 97.0ºF, heart rate 160 beats per minute, respiratory rate 70, room air oxygen saturation 90%.

Infant admitted to NICU at 45 minutes of life for symptomatic hypoglycemia (glucose 10) and hypoglycemic seizure.

Setting/Environment: NICU
Simulator: SimNewB™
Mode: Preprogrammed scenario

Scenario Objectives:
Recognize signs of hypoglycemia
Recognize key signs of impending respiratory failure (apnea, low heart rate, and cyanosis)
Demonstrate the ability to appropriately insert intravenous catheter
Demonstrate the ability to adequately perform positive pressure ventilation by mask and assist with endotracheal intubation if needed

Equipment Available at Bedside:

Patient ID Band	O_2 tank
Monitor leads	Bag/mask
Blankets	IV Cathlon
Cap	Tegaderm
Pediatric Stethoscope	Tape
Bulb Syringe/Suction	Endotracheal Tube

APPENDIX E

INSTITUTIONAL REVIEW BOARD APPROVALS

UNIVERSITY of NORTHERN COLORADO
Institutional Review Board (IRB)

June 6, 2011

STUDENT'S COPY

TO: Maria Lahman
Applied Statistics and Research Methods

FROM: The Office of Sponsored Programs

RE: Exempt Review of *High-Fidelity Simulation in Nursing Practice: The Impact on Nurses' Knowledge Acquisition, Satisfaction, and Self-Confidence*, submitted by Nicole R.D. Square (Research Advisor: Carol Roehrs)

The above proposal is being submitted to you for exemption review. When approved, return the proposal to Sherry May in the Office of Sponsored Programs.

I recommend approval.

Signature of Co-Chair 6/9/11
Date

The above referenced prospectus has been reviewed for compliance with HHS guidelines for ethical principles in human subjects research. The decision of the Institutional Review Board is that the project is exempt from further review.

IT IS THE ADVISOR'S RESPONSIBILITY TO NOTIFY THE STUDENT OF THIS STATUS.

Comments: 6-9-11 sent email

25 Kepner Hall – Campus Box #143
Greeley, Colorado 80639
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WOMAN'S HOSPITAL FOUNDATION
INSTITUTIONAL REVIEW BOARD
WOMAN'S HOSPITAL FOUNDATION
Support Services Building
9050 Airline Highway
Baton Rouge, Louisiana 70815

Peggy Dean, R.Ph. MBA, Chair (225) 231-5459

June 30, 2011

Nicole Square, MSN, RNC-NIC, BC
9050 Airline Hwy
Baton Rouge, LA 70815

Dear Ms. Square:

On behalf of Woman's Hospital Foundation Institutional Review Board, I have received and reviewed the protocol, letter of invitation, informed consent form, questionnaires, and assessment questions for RP-11-005, High-Fidelity Simulation in Nursing Practice: The Impact of Nurses' Knowledge Acquisition, Satisfaction, and Self-Confidence, submitted on June 22, 2011, for exempt review. I have determined that this study does meet one or more of the following criteria for exempt status:

> Research is conducted in an established or commonly accepted educational setting involving normal educational practices, such as research on regular and special educational strategies or research on the effectiveness of or comparison among instructional techniques, curricula or classroom management methods.

This study does not require continuing review; however, any changes that are made to the approved exempted proposal must be submitted for review by the IRB prior to implementation. The IRB will be notified of this approved exempt review at the August 8, 2011, meeting.

Thank you for keeping the board informed of your activities.

Sincerely,

Peggy Dean, RPh., MBA
IRB Chair

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