PEDIATRIC SIMULATION AND THE DEVELOPMENT OF ENTRY LEVEL SAFE PRACTICE IN NURSING STUDENTS

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IN NURSING STUDENTS

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CHAPTER I

INTRODUCTION

This dissertation will consider the use of simulation as a pedagogical approach to developing entry-level safe practice skills in nursing students. An experimental approach will be used placing students in one of two learning conditions: the first condition being a traditional clinical rotation in the hospital, and the second condition a hybrid experience of a hospital clinical rotation and a simulated laboratory experience. To introduce the reader to the need for this study, chapter one will open by presenting the varied crises facing nursing education today and the resulting need for new pedagogical approaches to experiential learning.

Chapter one will then discuss the meaning of entry-level safe practice in the profession and its development in nursing curricula. This will be followed by presentation of the problem statement, the null hypothesis, and its ensuing study questions. The chapter will conclude with the significance of the study for theory, practice, and research within the fields of nursing and educational psychology.

Simulation in Nursing Education

Nursing is a practice discipline and has never been taught solely in the classroom setting; nursing education has evolved from its conception as "on-the-job training" to hospital apprenticeships, to finally being housed in a university. This transition into a university education mirrors the increasing complexity at the bedside. There is a need for greater academic rigor in nurse preparation. Experiential leaning has always been valued as an integral and non-negotiable approach to the development of a nurse. As transitions in nursing education are faced with issues such as the nursing shortage, the aging of the population, and the increasing use of technology at the bedside and in medical treatment, there is a call from many nursing organizations (National League for Nursing (2008), Sigma Theta Tau(2008) for educators and practicing nurses to collaborate in nurse preparation.

The platform for this collaboration can be found in the simulated environment which holds promise to be the connecting bridge between classroom rigor and clinical complexity (Jeffries, 2006; Maddox, Wakefield, & Bull, 2001; Morgan & Hogg, 2000; Schoening, Sitner, & Todd, 2006). Nursing schools are buying into simulation, but the pedagogical approaches to this methodology remain largely untested, resulting in much skepticism as to the effectiveness of the ability of simulations to produce desired outcomes. A simulated environment at its best allows educators to manipulate the conditions to meet the student objectives and allows students to learn through a scaffolded approach how to take care of complex patients in a safe environment. At its worst, a simulated environment loses the human side of care, lacking in human responses, emotions and individual complexity.

Though simulation has been used in nursing education for decades in the form of low-fidelity simulation (fake arms to learn phlebotomy skills), high-fidelity simulators have only appeared in health education starting in the 1990s. These high-fidelity simulators (human patient simulators or HPS) can mimic patient vital signs, color, talk, and also produce bowel, cardiac, and respiratory sounds in the appropriate anatomical places. HPS was originally piloted in anesthesia curriculum, and today it is beginning to be integrated into nursing programs throughout the United States. Each simulator costs approximately $360,000 (Alinier, Hunt, Gordon, & Harwood 2006). Unfortunately, schools are purchasing this equipment and then largely finding themselves one year post purchase not utilizing the equipment for multiple reasons including the complexity of the instruments, a shift in educational philosophy to learner centeredness, and a lack of theory and models directing the effective use of HPS (Billings, 2006).

The creation of virtual hospitals and patients in the laboratory is needed in nursing education for many reasons, ranging from patient safety to good pedagogy. Though the literature will reveal scholarly study in the use and evaluation of simulation in nursing is limited, the profession cannot wait as noted by Gaba (1992): “... no industry in which human lives depend on the skilled performance of responsible operators has waited for unequivocal proof of the benefits of simulation before embracing it” (p. 491). The reality in nursing education is yesterday’s model of preparing students in the clinical/practicum setting is no longer feasible due to the rapidly changing health care environment. This health care environment can be characterized twofold by: (1) a critical shortage of nurses and (2) high acuity patients (patients who are sicker and require more care than 20 years ago). Both of these factors interplay, contributing to a health care milieu ripe for detrimental error from medication errors to missing critical assessment cues in the deteriorating patient.

Characteristics of the Health Care Environment

Nursing Shortage

By the year 2010, it is predicted that the United States will have a deficit of more than 1,000,000 nurses to meet the demands of the public. In response, there has been much public effort to recruit high school students early on into nursing. The American Association of Colleges of Nursing reports seven consecutive years of increased enrollment in nursing schools (2009). Though these trends have a long way to continue before any relief from the nursing shortage is foreseeable, the consequences of the increased number is a significant lack of clinical sites for student preparation (Medely & Horne, 2005). Schools of nursing are continually competing with each other to have access to hospitals for experiential learning. Practical clinical hours for students in many universities now run 24 hours around the clock and on weekends simply to gain access to the clinical sites within the hospital setting.

The consequence of this lack of site availability is students graduating with limited clinical experiences. According to the Society of Pediatric Nurses (2008), pediatric nursing is largely being taught at the theoretical level as the number of hospitals available for children are vastly less than the number of adult hospitals,. The general lack of site availability is forcing nurse educators to consider alternatives for experiential learning, as it is generally agreed that it is not an option for a nurse to graduate with cognitive knowledge only (Medely & Horne, 2005; Lassater, 2007). Accrediting bodies for schools of nursing are having to consider the acceptance of alternative experiences in place of clinical hours. Sixteen states have now received permission from their regulatory boards of nursing to replace clinical with simulated hours (Rothgeb, 2008).

The nursing shortage is not confined purely to health care providers but also to nursing educators. A 2002 National League for Nursing survey reports statistics that show an aging faculty, 75% of whom will retire by 2019, and also an increasing part-time faculty who hold dual roles in practice and academia (2008). Graduate nurse education tracks are closing down and are being replaced largely with the nurse practitioner tracks. Reasons for this are cited as salary differentials nurse practitioners making two to three times the salary of faculty, as well as the demands placed on faculty of being experts in the dual fields of practice and education.

The nursing faculty shortage is directly contributing to the overall nurse shortage, For example, in an Association of American Colleges of Nursing (2003) survey, it was determined that 32,797 qualified applicants were turned away from nursing programs; the reason for this cited 47.8% of the time was insufficient faculty. A national sample of 395 schools was surveyed finding an 8.1% vacancy of faculty positions. It is a vicious predicament where the education system's capacity is limited by a lack of faculty, an increased enrollment of students, and lack of clinical site availability for nurse preparation. All these issues feed each other in a vicious cycle; for example, increasing student numbers contributes to decreasing clinical site availability, which leads to faculty working all shifts, leading to faculty burnout, leading to reduction in students being admitted to programs. It is ironic that at the same time health care faces its biggest shortage of workers, reports come out such as "record numbers of potential nurses await places in America's RN programs" (Klestzick, 2006, p.1).

An added concern to these alarming faculty numbers is that the current faculty is under-prepared to take on the challenge of simulation pedagogy. The National League for

Nursing in a 2003 report on the state of nursing education found that nurse educators largely taught as they have been taught and for a health care system that no longer exists today. The percentage of doctorally prepared nurse faculty has changed; in 1993, doctoral preparation was almost equal among faculty whose age was above 50 to those who were younger. The 2004 report shows faculty in the 56+ category increased their doctoral preparation by 19.5%; in contrast, there were decreases in doctoral preparation in all faculty age groups under 45. The decrease is in part related to the cycle of events already described causing faculty to leave academia (American Association of Colleges of Nursing, 2003).

Long (2004) reports that despite the advances in sciences, technology, pharmotherapeutic agents, and medical interventions in the last two decades, little has changed in nursing education. A recent survey of the use of human patient simulators in nursing schools showed less than 5% of curricula time was devoted to this pedagogical approach despite the overwhelming agreement among faculty that the simulator allowed for improved critical thinking skills, allowed for an opportunity to apply theory to practice, and helped with the transition into the clinical settings. Reasons for not using the simulator included: computer anxiety, lack of technical support, and lack of faculty development time (King, Hindenlang, Moseley, & Kuntz, 2008; Nehring et al., 2004).

A mandate issued by the National League for Nursing in its 2003 report was in part for nurse educators to focus on evidence-based pedagogy and increase the use of available technology in nursing education. A strong recommendation by the National League for Nursing was for faulty to "re-think clinical education in order to design new methods that meet student needs to learn practice and prepare graduates to thrive in today's health care environment" (2003, p.3). A paradigm shift is required by faculty from a teacher-centered to learner-centered experience. This is noted by Billings: "For faculty today, the challenge is to work on making the shift from teaching to learning, to focus on higher-order learning, and to use the teaching tools and technology that help students learn" (2000, p.61). The nursing faculty shortage is not conducive to the major shifts in thinking required.

High Acuity of Hospitalized Patients

Another characteristic of today's hospital environment is that patients tend to be older and also sicker than 10 years ago, resulting in more difficult and complex care. Decisions nurses are making at the bedside today are multi-level and require critical thought, judgment, and collaboration. Factors contributing to the increased acuity of the patients seen today include an increase in underlying chronic illness, improved pharmacological agents, increase in use of life-saving technology, and also the primary payers setting limits on length of hospital stays. These factors will not change, acuity will remain high, and the implication is that nursing education must respond to these changes in the practice setting.

With 60% of patients admitted to the hospital having underlying chronic illness process, even simple admitting diagnoses such as fractures are complicated (Lubkin & Larsen, 2006). The implications of this for nursing education are significant. For example, it is very difficult to follow the traditional educational strand of starting simple and building to complex when there are no simple patients with one diagnosis in the hospital anymore. Beginning nursing students are immediately exposed to multi-cause complex illness in the hospitalized patient.

The oldest baby boomers will turn 65 in 2011. In 2030, 26% of the U.S. population will be 65 or older as compared to today's 17% (Bostrom, 2005). This aging of the U.S. population is adding to the complexity of the disease processes in geriatric clients, who no longer have efficient organs to combat and tolerate illness and medications. Hospital acute care beds across the country are predominantly filled with 70 year old and greater aged patients.

Another factor that has contributed significantly to the complexity seen at the bedside is the increasing use of technology. For example, today neonates of 21 weeks gestation are being resuscitated with reasonable chances at living. Heart failure patients who would have died a mere 10 years ago are now being discharged home to await transplantation with the use of external left ventricular assist devices to pump their failed hearts. Liver dialysis, high-dose chemotherapy, complete bone marrow suppression, intra-aortic balloon pumping, and extra corneal membrane oxygenation are examples of everyday life-saving technology at the bedside in large hospitals throughout the United States.

The conversations of nursing curriculum reform are not any longer about content. Content is changing so rapidly in the 21st century that if the curriculum were content-focused, a graduate nurse would be outdated within the first 10 years of practice. The conversations are about process and include questions such as how to effectively prepare beginning nurses to work in multi-level complex environments. Communication skills, collaboration with other professionals, technological skills, and "real life" case studies should be key in preparing students for health care delivery today and in the future.

Undoubtedly, there needs to be an active dialogue between educators and the needs of the practice setting to adequately prepare the next generation of nurses (Long, 2004).

Patient Safety

In the education of a nurse, safety is a central concern for the profession from the beginning level student to the graduate. It is estimated that between 44,000 and 98,000 people die each year as a result of medical errors (Holtshneider, 2007); this is unacceptable. Nurses are the largest component of the health care workforce and are directly involved with care provision, supervision, patient education, and research. Nurses are often the last safety check before an error is made. For example, the physician orders the wrong dose of medication, the pharmacist fills the prescription, and the nurse administers the incorrect dosage.

Concerns about patient safety have recently received increased visibility in the public arena with reports appearing in mainstream publications such as *Better Homes and Gardens* and *The Chicago Tribune*. The general direction of these reports is that death was preventable and largely a result of poor nursing care (Maddox, Wakefield and Bull, 2001). As a response to these reports, the Institutes of Medicine has explored key issues in patient safety and concluded that there are few tangible actions to improve patient safety to be found (Nishisaki, Keren, & Nadkarni, 2007). The errors found even though significant were very broad, making it impossible for the Institutes of Medicine to identify specific reasons for error. The report was summarized with four messages: (1) The magnitude or amount of error occurring is great; (2) failures are largely system related and not specific to individuals; (3) reporting of errors needs to increase; and (4) health care systems need to focus on error reduction. The implications of these messages for nurse education is that nursing can no longer be perceived as a solo practice; it is essential for students to work within systems and teams of interdisciplinary caregivers. Students need the opportunity to look at where errors begin and understand the circumstances that led to the error; unfortunately, this is not readily accessible information in the clinical setting. However by incorporating purposeful error into simulated situations, a valuable learning tool is constructed. For example, when a medication order written in error fails to mention the route the drug should be delivered, the nurse in error assumes the drug is an intravenous medication and delivers the drug in this manner. The student will see the deterioration in the simulated patient and be able to rewind and identify first the error in the written order and then identify reasons why he or she assumed it was an intravenous drug.

Simulation provides not only an opportunity for reviewing errors in a safe environment, but also several studies have shown that simulation is important in learning the skills of working in a team, valuing input from others, and planning for interdisciplinary purposes (Henneman & Cunningham, 2005; Holtschneider, 2007; Wakefield, Cooke, & Boggis, 2003). Hospitals are now using simulation with several members of their staff to practice interdisciplinary planning and functioning in crisis situations. Allowing students to commit errors in the clinical setting is clearly not an option. Also, the concept of professional collaboration is complex, and beginning students are not able to carry this out effectively in the clinical setting. Providing an environment where they can learn team skills and communication is an important part of socializing the student into the professional role.

Entry-level Safe Practice for the Beginning Nurse

After completion of nursing school, all graduates are required to sit a national exam to become registered and legally licensed to practice nursing. The national council licensing exam NCLEX (2008) has been developed to assess the competence of a candidate for nursing practice (Silvestri, 2005). The content of the NCLEX exam reflects the activities that a newly licensed, beginning nurse must be able to perform to provide safe, effective nursing care to clients. This study will be examining how simulation affects the development of the required safe practice level.

Nursing is an applied science and therefore entry-level competency in the field is not simply mastery of the content, but also an ability to apply the content safely and effectively in a practice setting. Application of the content learned in a nursing curriculum is larger than the content itself. Application of the content requires an integration and synthesis of the content within unique situations or requires the thinking of a nurse within the frameworks and theories of the discipline (Elder & Paul, 2003). This thinking must be systematically and purposefully cultivated in a curriculum. Thinking like a nurse is not a natural consequence of completing a nursing curriculum, Elder and Paul (2003) use the example of people who have studied science yet when they leave school and function professionally, they fail to think scientifically in their professions. Failing to think “like a nurse” leads nurses to make decisions outside of the tested and established frameworks of the discipline. For example, a nurse who does not use the accepted disciplinary framework of Maslow’s hierarchy of needs may fail to prioritize care appropriately (Kozier and Erb, 2008). In this example, a nurse may wrongly choose to treat a client’s pain prior to treating their low oxygenation status, resulting in immediate comfort for the patient but also resulting in cellular death and long-term consequences for the patient. Thinking outside of the discipline's framework can be detrimental. In all subjects and disciplines, there is a fundamental logic and reasoning that is defined by the structure of the thoughts nested within that discipline (Elder & Paul, 2003). Gaining an understanding of the thinking of the discipline is especially important with the increasing complexity of patient care in the acute care settings today.

Coles (2002) describes this nurse thinking as the development of professional judgment: "professionals are asked to engage in complex and unpredictable tasks on society's behalf, and in doing so must exercise their discretion, making judgments – decide what is *best* in the particular situation rather than what is *right* in some absolute sense" (p. 3) He notes in his article that many of the problems faced by professionals are uncertain and often complex, having no clear resolution; in these situations, professionals must use practical wisdom in their decision making process, and this wisdom is larger than the sum of its parts. Cole describes the wisdom as being developed through the "critical reconstruction of practice" which is not simply reflection but a wisdom that is taught and acquired through experience and conversation with leaders in the practice (p. 8).

Tanner (2006) reviewed the literature on clinical judgment in nursing, which is comparable to Coles' (2002) professional judgment, or Elder and Paul's (2003) thinking. She found multiple terms for this larger than the content idea that were used interchangeably; these included: competence, clinical judgment, decision making, and critical thinking. Based on a review of 200 studies, she identified the following five conclusions about clinical judgment:

1. Clinical judgments are more influenced by what nurses bring to the situation than the objective data at hand (p.204).
2. Clinical judgment results from an interactive knowing the patient and their typical responses.
3. Clinical judgment is influenced by the culture of the nursing environment
4. Nurses use a variety of reasoning patterns.
5. Reflection on practice is frequently initiated by a breakdown of clinical judgment.

The NCLEX test (2008) is an examination that tests beyond the sum of knowledge acquired in nursing school; the tests determines if the test taker is safe to practice and to individualize the care required for unique patient situations. Vertical strands that are common to nursing curriculum include, the development of the thinking of a nurse and the socialization of the professional through experiences and conversations, these strands have a common outcome of producing a safe entry level nurse. Simulation is an ideal tool to nurture the experiences and conversations needed to develop safe practice (Lassater, 2007).

Statement of the Problem

The problem addressed in this study is that there are inadequate clinical/practicum sites to prepare nursing students for today's health care environment. Though historically nursing education has used a weekly model of classroom work followed by clinical experiences, this model is proving to be outdated and ineffective for both the needs of the student and the clinical agencies involved. This pedagogical approach is no longer effective for multiple reasons. First, the increased enrollment in nursing schools has completely saturated the clinical agency site availability. Second, there is a shortage of nurse educators available to cover 24 hours of staffing for student experiences. Third, the complexity of patients health needs in the hospital and their shortened lengths of stay are not conducive to the learning needs of beginning students. Finally, it is ethically questionable to allow a student to “practice” on a patient to whom the discipline has sworn no harm.

Contributing to the problem is there are no well researched alternatives to nurse preparation other than use of the live clinical setting (Bearson & Wilker, 2005; Jeffries, 2007; McFetish, 2006). Simulation has gained popularity in nursing education; however, not enough vigorous studies have been completed to suggest that a virtual clinical experience is an effective nurse preparation tool. Finally, even if the literature was current with supportive simulation studies, it is foreseeable that the transition to a simulated learning experience would be very difficult for already strapped nurse educators (who as the literature describes are experiencing a significant shortage in number of educators and qualifications needed).

Purpose of the Study

The purpose of the study is to investigate how simulation contributes to the development of entry-level safe practice in the nursing student. Entry-level safe practice will be measured using the Educational Resource Incorporated Nursing Care of Children exam (peds ERI) (2008); this exam evaluates safe nursing care for a beginning nurse in the pediatric setting. The peds ERI exam (2008) and its correlation to the NCLEX (2008) exam is described more fully in Chapter 3. The following null hypotheses will be stated for the study:

Null Hypothesis: There is no differences in score on the Peds ERI exam between simulation and clinical groups. H_o: $\mu_c - \mu_e = 0$.

The following study questions are posed to assist in accepting or rejecting this null hypothesis:

1. How is entry-level safe practice in the nursing process affected by simulation versus clinical experiences?

2. How is entry-level safe practice in the area of patient need identification affected by simulation versus clinical experiences?

3. How is entry-level safe practice in the use of critical thinking affected by simulation versus clinical experiences?

4. How is entry-level safe practice in the area of pediatric topics affected by simulation versus clinical experiences?

The development of entry level safe practice requires application of the content and practice in a real environment (Long, 2004). This study will measure how simulation contributes to the development of entry-level safe practice in the pediatric clinical setting.

Significance of the Study

For a study to be significant it should impact the discipline at multiple levels, including the levels of research, practice, and theory. To varying degrees, this study impacts all these levels in both the discipline of nursing and educational psychology.

This study is significant to nursing practice because it will consider the how simulation contributes to entry-level clinical safe practice. If simulation has a positive or neutral effect on entry-level safe practice, the study will give support to use of simulation as an alternative experiential learning site. A positive effect will suggest that use of simulation in this population was a better teaching methodology for entry level safe practice in the pediatric setting. A neutral effect would suggest that simulation has no adverse effect in this population on the development of entry level safe practice. Either result is significant because it provides a possible solution for the problem at hand being that of inadequate clinical sites for practicum experiences.

The study is also significant to educational psychology because it will be framed by constructivism as a philosophy for teaching undergraduate nursing students. Principles of experiential learning theory will also be integrated to develop the simulation intervention. Finally, the nursing simulation model will be used as a frame to complete educational psychology, which adds significance to the study. The synergy produced by the interactions will provide a vigorously studied approach to developing a pedagogical approach in nursing education.

Research

The National League for Nursing has set 11 research priorities for creating reform in nursing education (2003). Four of these priorities are directly addressed by this study technology, including new approaches to laboratory/simulated learning; (3) student/teacher learning partnerships; and (4) clinical teaching models.

The area of simulation in nursing education is new, and the literature base is very thin (Jeffries, 2007; Ravert, 2002). Almost all the studies reviewed in the literature mention the lack of vigorous, scholarly study in the area of health care simulation. Ravert as recently as 2002 reports that there are only two published studies with human patient simulators and undergraduate nursing students. In addition, the literature review in Chapter 2 will show that the research completed as recently as 2008 is frequently conflicting, and many larger-scale studies are still needed. A report by Alinier and colleagues (2006) out of the United Kingdom states: "Most experts in the field still believe that more research is needed to prove that skills acquired in a simulated environment are transferable to real patient care and that simulation is a cost-effective teaching method" (p. 360). As Jeffries (2007) concludes, the practice of simulation is ahead of the literature. This study will contribute to the literature that guides the practice of nursing education.

Practice

In a practice discipline, there needs to be a dynamic relationship between research and practice, both contributing and shaping the other (Fawcett, 1978; Long, 2004). Long (2004) promotes the collaboration of nurses in both areas of nursing practice and research. This collaboration is evident in the guidelines set by the National League for Nursing (2003) that call for a partnership between the clinical setting and the classroom rather than requiring faculty to be experts in both areas. Simulation becomes an ideal platform for this collaboration with faculty creating the instructional design and practitioners inputting into the design real patient issues. Jeffries (2007) has recently proposed a new framework for simulation design. This study will contribute to the growth and advancement of the discipline of nursing by giving credence to this framework; it will also contribute to the advancement of the educational psychology discipline by supporting already established experiential learning theory.

Theory

There is concern among educators that the fascination with simulation is causing many educators to simply purchase the equipment and then hope for the learning outcome. Bligh and Bleakley (2006) state that the literature on simulation tends to be more descriptive than reflexive. They believe “the simulation community in clinical education has not developed a scholarship” (p. 608). There is a need for simulation to become structured by developed educational frameworks and theory. The current study will contribute to the theoretical area by using experiential learning theory to guide the simulation design.

Definition of Terms

The scope of simulation pedagogy is unlimited because of the spectrum of equipment that is categorized as simulation. This equipment can range from a dummy arm (low fidelity) used for IV insertion to very advanced computer-based equipment (high fidelity) that simulates multi, complex clinical problems. The pedagogic approach to simulation varies according to the type of simulation being performed. The challenge to the nurse educator is to choose the best teaching methodology in order to accomplish the educational objective.

For the purposes of this study, high-fidelity simulation will be used with human patient simulators that provide a high level of interactivity and realism for the students. The following definitions will be used for this dissertation:

Clinical: a practicum in hospital experience. The student is assigned to a patient and carries out the nursing care required under supervision by the patients' assigned registered nurse. A faculty member oversees the experience and at the conclusion of the day debriefs the events of the clinical with the students.

Entry-level safe practice: Successful passing of a national council of licensing type exam (NCLEX) (2008) that include the following NCLEX identified components: cognitive ability (pediatric content), client needs category (safe, effective care environment, health promotion and maintenance, psychological integrity, physiological integrity), an integrated process (critical thinking, nursing process).

Simulation: A lab set up to mimic clinical reality with the use of human patient simulators, bringing real life activity into the learning lab. A faculty member will conduct the simulation controlling the patient responses, writing physicians orders, etc. At the end of the simulation, the events will be debriefed with the students and faculty.

Simulation pedagogy: effective teaching methodology in a virtual environment (Bull, Montgomery, & Kimball, 2000).

Human patient simulators: a life-sized mannequin with computer software that allows it to have physiological sounds (such as heart tones, lung sounds, bowel sounds). The mannequin has palpable pulses and artificial blood in its veins. It can be anatomically fitted to be male or female. The patient can speak and respond to student questions (faculty voice through a microphone). A computer can program a scenario into the human patient simulator or a faculty member can run the scenario based on student intervention.

CHAPTER II

REVIEW OF LITERATURE

This chapter provides the theoretical base and framework for the proposed study. It begins with an introduction to constructivist philosophy. Constructivism will serve as the overarching philosophy for the two disciplines of nursing and educational psychology. First from the educational discipline, experiential learning theory will be presented and then from the nursing discipline a simulation model will be presented. This theory and model will serve to build the frame for the simulation intervention to be used.

Following the presentation of theory is a thorough synopsis of current studies in simulation. The studies are reviewed based on the outcomes measured. The literature review is concluded with two meta analyses of simulation usage in nursing and medical education.

Constructivism

Constructivism is a philosophy that is concerned with the way humans acquire knowledge and learning. Constructivism is discussed in the literature at many levels from a radical constructivism to pseudo constructivism, with the main difference being the extent to which reality is constructed in the mind of the learner (Cronje, 2006). For the purposes of this study, a radical constructivist thinking will be used where reality is structured by our own personal constructions as a result of interactions with our environments. Jaworski (1996) simplifies this constructivist view with the two following principles:

1. "Knowledge is actively constructed by the learner, not passively received from the environment" (p. 2).
2. "Coming to know is a process of adaptation based on and constantly modified by a learner's experience of the world" (p. 2).

Simulation pedagogy is very naturally framed by this philosophy and its principles. Simulation pedagogy mimics the real world and embeds the learner in a virtual reality. The learner interacts within the simulation and thereby constructs knowledge as he or she would in the real world setting.

Constructivism accepts that learning is dependent on previously existing knowledge and that learning occurs within a context. All learners come with different histories and discourses; as they are introduced to new content, the learners must organize and re-pattern these new ideas into already existing schemas to make personal sense. Cronje (2006) describes the process of forming meaning as the end result of this interpretive process which is dependent on the experience and understanding of the knower. Therefore, in the constructivist approach, the primary focus is on the learner with the teacher facilitating the transformation of knowledge by stimulating the student's cognitive structures. The teacher's role becomes one of a facilitator, encourager, prober. The teacher no longer has a rigid, prescriptive classroom plan but rather comes alongside the individual student and adapts the teaching role toward the student need.

Learning in Constructivism

Constructivist learning favors conditions where learning is socially and culturally embedded: There is positive emotion, and the learning is personally owned, appropriately timed, and constructed in reality (Bull, Montgomery, & Kimball, 2000; Cronje, 2006). A good simulation can be designed to fit all these conditions. For example, student learning occurs as a social and cultural process, where the learner dialogues with others and the material to assimilate the ideas into their own experience. In simulation, students are confronted with alternative opinions they must consider as they work with their peers, and underlying assumptions should be shown to students by their peers or the teacher. All these new ideas cause disequilibrium in a student's understanding, and time should be allowed for the student to find balance; this can be done through a debriefing or reflection time. In general, as the literature will show, simulation makes the learner feel good, and there is much excitement, satisfaction, and self confidence produced through the process (Jeffries, 2006; Weller, 2004). Educators need to be careful not to produce too much emotion in simulation. As Bull et al., (2000) demonstrate, the emotion performance curve is an inverted "U " shape, and too much emotion can decrease learning.

At the beginning of a simulated experience, the learner and teacher set goals together, creating a relevancy and ownership to the learner; when the student sees the objective as relevant, motivation is naturally increased. Frequently with shared objectives, the teacher has to adapt the instruction to include just-in-time learning so the student can progress. Again, the classroom is no longer prescriptive but becomes fluid and flexible, adapting to the student's learning need.

Finally, constructivism believes that the construction of reality is integral to the process of learning, which is what simulation embodies. Though the literature review will show that often the authenticity of the situation is cited as the weakest point of the experience, students continue to say they feel better prepared to work in the real world (Lassater, 2007; Jeffries, 2006; Madorin & Iwasis, 1999) Learners come into simulated scenarios with diverse world views, experiences, and backgrounds, within the simulation the learners must work together to come to consensual agreement and satisfactory conclusion for all. The learning becomes a process of social negotiation and active participation within the context of the scenario.

The traditional apprenticeship-type approach to nursing education in the form of an eight-hour clinical day is clearly a socially and culturally embedded learning experience. Despite this, however, many of the ideas of constructivism do not fit a clinical learning experience; for example, the emotions involved (fear, stress, sadness) with going to the clinical setting can be so high that learning cannot occur effectively. The clinical setting is also a very difficult site for faculty to provide a scaffolded-type experience; there is no ability to control the type of patient the student will receive, and also there is no ability to play and replay the learning scenarios (such as medication administration) where students can self evaluate and assimilate the new learning. In addition, in the clinical setting there is limited time to allow the learner to think, reflect, and go slowly through the processes that are second nature to an experienced nurse. Table 1 compares the simulation and the clinical setting; strengths, limitations, and the relationship to learning theory of each condition is presented.

Table 1: Evidence of constructivist philosophy in simulated and clinical settings

Control	Experimental
Interchange of instructional approach based on learner's response. Limited ability to change learning environment.	Interchange of instructional approach based on learner's response. Much flexibility to change the learning environment (such as decreasing environmental stressors, increasing think time)
Use of spiral curricula approach however limited to client availability, often difficult to connect to matching week in classroom work.	Use of spiral curricula approach, content readily connected back to the classroom on a weekly basis as courses progress.
Learning always anchored in authentic task in live setting.	Learning anchored in authentic task in simulated setting. Authenticity decreased for many reasons including non-human response from sim man.
Use of just-in-time learning.	Use of just-in-time learning.
Use of shared objectives, however achievement of these objectives dependent on type of client and disease processes.	Use of shared objectives, achievement possible in simulated setting.
Debriefing time: each student has a different	Debriefing time: all students have one common

patient, discussion broader.	patient, discussion focused.
Fidelity: Situation always real. Unpredictable.	Fidelity: Limited realness created, predictable setting making it less authentic.
Highly complex clients, very individualized.	Less complex clients, can match the textbook.
Use of cues limited in the client's room. Error unacceptable.	Use of cues easy in the client's room. Error acceptable.

An important outcome of both simulated experiences and clinical experiences is the socialization of the student into the discipline. At the end of the learning experience at the application level, it is important that the student can articulate and understand the learning not just for the content it represents, but also within the frameworks of the discipline. Thinking within the nursing frameworks and assimilating this into the student's schema is part of the socialization process which Coles (2002) refers to as a "critical reconstruction of practice," (p. 8); this rethinking begins the formation of entry-level clinical competence. This is vital since thinking that is structured by the discipline's theories and models (that have been scientifically tested) should lead to safe and effective practice.

Instructional Design using Constructivist Principles

Constructivism is a theory of learning, not a theory of teaching; the two ideas are philosophically contradictory. Unfortunately, the two are frequently meshed in the literature and in practice, resulting in both ineffective research and teaching (Jaworski, 1996; Winn, 1997). In contrast, the design for this study will use constructivist theory to guide the instructional design but not dictate it (prescriptive, step-by-step design will not be used, rather a design that allows a continuous interchange between the teacher and the learner). Instructional methods will be selected or developed as the scenarios unfold in an immediate response to what the student thinks and does. The assumptions for this type of design are that not all learners think logically and predictably, and that the students are bringing their own learning experience to the scenario and therefore responding differently to the environment.

Instructional design using constructivist philosophy supports several instructional principles with the first being a spiral curriculum (Bull, Montgomery, & Kimball, 2000). In spiral curriculum, the learner is repeatedly exposed to the content during the course of learning. Learning occurs as the learner interacts with the content and begins to ask questions that are larger than the content itself. The learner uses the new content as a platform to seek and integrate more knowledge. A second principle of design shaped by constructivism is to anchor the learning in an authentic task that is larger than the immediate learning. For example, the overall learning objective may be to teach the student how to care for a client with pneumonia, but the student's immediate learning need may be simply how to auscultate lung sounds (an important piece in the overall care of a client with pneumonia). The idea is that the learner will be able to use the pieces of information (auscultation of lungs) in multiple capacities at multiple levels in different learning experiences. Thirdly, another important principle in instructional design is capturing the interest of the learner and making the experience meaningful and immediately useful. These conditions increase ownership and motivation to learn. A fourth principle is that the design model should be holistic and spiral. Within the learning experience, there should be multiple layers of objectives that the learner works through as he or she builds knowledge and understanding. Just-in-time leaning, learning aids, and other methods are important to fill in knowledge gaps as the learner progresses.

Students will be coming to the learning situations with different levels of understanding (Bull, Montgomery, & Kimball, 2000). In instructional design, the needs for each level should be identified so all learners can progress and add to their knowledge. It is important that students take ownership and become responsible for their own learning. This can be achieved through shared objectives between the student and the teacher. It is the process of the thinking in simulation that is important, not necessarily the performance of task A and B. For example, if a student makes an error in medication administration, that error should be allowed to continue through the scenario so that the student can see the consequences of the error. It does not matter that the student did not successfully deliver the medication; the learning through the process was still valuable. This is a difference found in the literature between medical schools' use of simulation and nursings', for nursing it is not purely skill acquisition educators are hoping to gain but rather a socialization process in the profession and the development of entry-level safe practice.

Ultimately with constructivist instructional design, learning should go beyond the content; students should be asking questions that build on previous questions as they explore new understandings (Bull, Montgomery, & Kimball, 2000). This learning beyond the content is another example of entry-level safe practice; the student is practicing nursing beyond the sum of the parts of knowledge, and the practice becomes a highly integrated response.

Education: Experiential Learning Theory

Experiential learning theory (ELT) draws on the work of notable scholars in human learning and psychology, including John Dewey, Jean Piaget, Carl Jung, and others (Goldhaber, 2000). ELT is grounded in the constructivist approach to learning, whereby knowledge is created and recreated dynamically within the personal experiences of the learner (Kolb, 1984). The basic premise of the theories is that all individuals learn differently; some, for example, think aloud and interact, while others sit quietly and reflect. The theory is built on six propositions briefly summarized in Table 2.

Table 2

Experiential Learning Theory Propositions

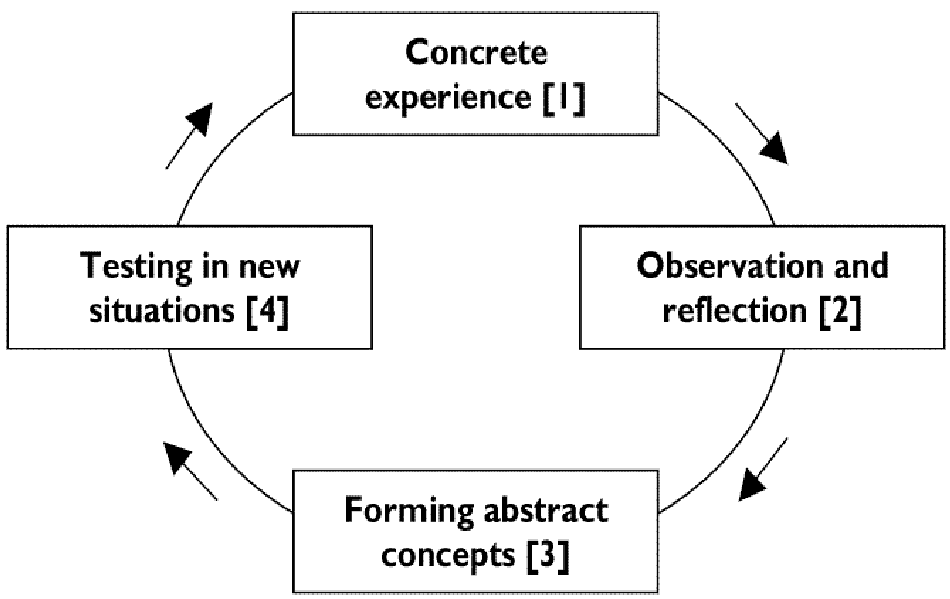
1. Learning is a process; it is a reconstruction of experience.
2. All learning is relearning (testing old ideas, integrating new ideas).
3. Conflict, disagreement drives the learning process as the learner must consider alternative points of view.
4. Learning is holistic, not just cognitive; it involves emotion, perception, behavior.

5. **Learning results from a synergistic interaction between the person and the environment.**

6. **Learning is the process of creating knowledge; it is social and created within the personal knowledge of the learner.**

ELT believes there are four points in the circular process of learning; these points are paired as polar opposites. In the first pair, abstract conceptualization contrasts concrete experience; the continuum between the two is where the learner grasps the information. The second pair of points contrasts reflective observation and active experimentation; the continuum between these two is where the learner transforms information.

Figure 1. The Experiential Learning Cycle



During learning, the student moves through all the polar ends of the cycle. Learning style is then determined by the learner's preference (length of time) at employing different phases of the learning cycle. As the learner understanding progresses in complexity, the four polar ends of the cycle become increasingly integrated. Knowledge processes from simple acquisition, to specialization, and ultimately to integration. The learner is now dynamically integrating new knowledge into the world and the experiences around him; this can be seen as entry-level clinical competence, using the nursing process to facilitate critical thinking, identify patient needs, and apply topical content to the scenario.

Kolb and Kolb (2005) argue that learning can begin anywhere in the cycle. In simulation, learning is most easily initiated as a concrete experience; the student is introduced to the patient, completes a physical assessment, and reviews the medical chart. The student then carries out an action and will move into phase two of observing and reflecting upon the consequences. Debriefing in a simulation experiences can aid the student at multiple points in the learning cycle. As noted in the constructivist philosophy, the outcome of the learning becomes bigger than the content itself. In phase three of the learning cycle, the student starts making decisions and formulating question at the entry-level competence of a professional nurse. The decisions made at this point focus on what is *best* for the patient as opposed to the concrete idea of what is *right*. For example, narcotic pain medication relief may not be the "right" answer for all clients in pain, rather the student must observe the patient's respiratory effort, kidney function, liver function and underlying disease process, and medical history to decide on the *best* approach to pain relief for this client. The use of expert faculty to dialogue with the students is essential in the shaping of the entry-level safe practice nurse.

Nursing: The Nursing Education Simulation Model

The Nursing Education Simulation Model (Jeffries, 2007) was developed as a part of the first national, multi-site, multi-method nursing simulation research project that was initiated in June 2003. Its purpose was to provide a consistent and empirically supportive model to guide design and implementation of simulation in nursing education. The model is eclectic and built on borrowed educational theory of constructivism, learner centeredness, and socio-cultural theory.

Figure 1. Simulation Model

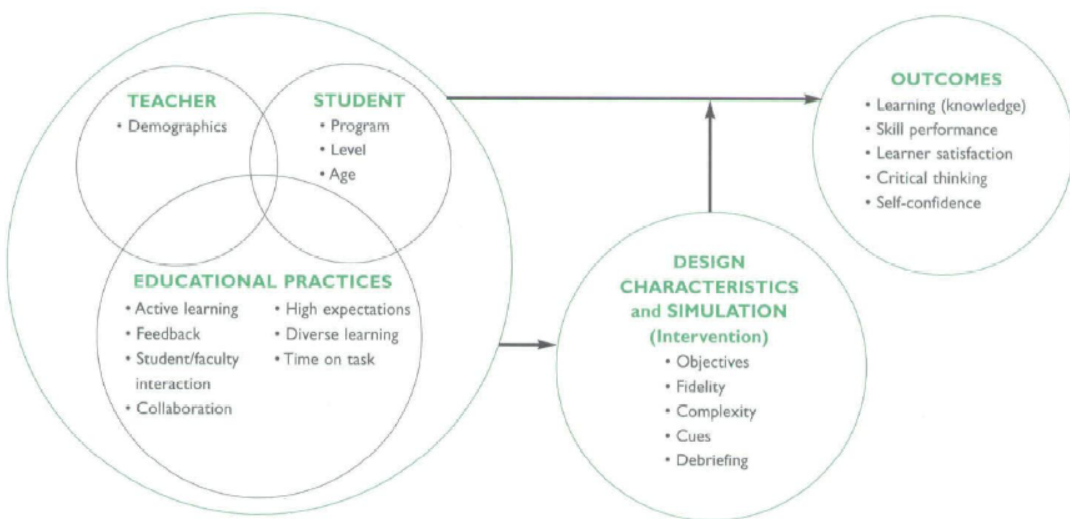


Figure 2. Nursing Education Simulation Model

Within the model, it can be seen that the five variables (teacher, student, educational practices, design, and outcomes) are made up of components that are embedded in constructivist philosophy and language. Learning occurs as a result of an interaction between the teacher and the student. Note that the teacher does not have a central role but is depicted as equal to the student; the teacher not only interacts with the student but also the educational practices. The student is not a passive recipient of information from the teacher, but actively constructs meaning. The student has ownership in this process and becomes responsible for his or her own learning.

The educational practices variable supports the two constructivist principles identified by Jaworski (1996). First, knowledge is actively constructed within the environment (that includes teacher, peers, and content) where the student interacts and receives feedback from the environment. Secondly, the student is engaged in collaborative learning where objectives are not complete until all students meet all the desired objectives. The collaborative environment (much like an authentic environment) requires that a culturally and experientially diverse group of learners come together and care for the patient.

The design characteristics and simulation variable is concerned with instructional design as opposed to learning (found in the educational practice variable). In high-fidelity simulation, real life is mimicked as closely as possible; this creates fidelity for the learning. Constructivists believe that for learning to occur, the environment should be as close to real life as possible. Within simulation, this is done with props but also with students role-playing who may be in the hospital room (family, chaplains, nurses, and others). Jeffries (2007) recommends that the student-faculty ratio in simulation is approximately 1:4 or 5; with this ratio it allows two students to be active participants and two students to be observers.

Student support in constructivist philosophy involves scaffolding; for example, the teacher provides cues to the student and thereby helps the student build a structure to assimilate/organize the information. During this process, the teacher can assess how much the student does or does not know and then provide the needed information for the student to continue on in the simulation. Vygotsky describes this as the zone of proximal development (1997) where the student is ready to learn but needs some assistance so that the learner can ultimately reach the goal of knowledge application.

Debriefing is noted throughout the literature as being the most important part of the simulation experience (Jeffries, 2006: Nehring, Ellis, & Lashley, 2001; Bligh & Bleakely, 2006; Holtschneider, 2007). This activity is a reflective process that allows the learner to reconsider why a decision was made. Reflection provides time to modify or adjust thinking. Bull et al., (2000) state that during reflection, the learner should have a coach or mentor to help organize, provide feedback, and offer alternative perspectives. In complex settings, Bull et al., (2000) encourage reflection with peers and faculty, who can provide alternative opinions and help identify assumptions. Coles (2002) agrees with this and describes it as a "critical reconstruction of practice," (p. 8). The debriefing period in simulation is a group activity with the faculty facilitating.

The final variable in the simulation model is *outcome*; various categories of outcomes are listed in the model: knowledge, skill, critical thinking, self confidence, and learner satisfaction. It is commonly believed that the literature lacks adequate tools for appropriately evaluating simulation outcomes (Jeffries, 2007; Nehring, Ellis and Lashley, 2001). Much of the research presented in this chapter will cite studies that measured outcomes at multiple individual levels. This approach however is reductionist, and the question must be asked: "Can a rich, reality-driven experience be evaluated by the sum of its parts?" For the purpose of this research, the outcomes of the simulation will be measured by a standardized national test (Nursing Care of Children's Education

Resources exam, peds ERI (2008) which measures overall entry-level safe practice for the pediatric practice setting. The peds ERI (2008) exam is a more holistic approach to measuring safe practice than evaluating multiple measures individually such as skills, knowledge gain, and critical thinking skills.

Current Studies in Nursing Education and Simulation

The review of studies in simulation will begin with a summary report from the National League for Nursing's multi-site study (Jeffries, 2006). This study was conducted over a three-year period and is the largest study to date in the field of nursing simulation. Several other smaller studies will then be reviewed highlighting the conflicting nature of results in this young literature base. This section will conclude with two comprehensive literature review reports on the state of simulation in nursing education.

National League for Nursing Multi-Site Study

The national study by Jeffries (2006) had three phases to it and utilized eight different nursing schools across the United States. Phase I was concerned with model development; the nursing education simulation model was the final outcome of this phase (as seen previously in Figure 1). Phase II was concerned with simulation design features and testing of the model. The study found that the most important simulation design feature was feedback/debriefing, and the most prominent educational practice was that of collaboration. Feedback/debriefing is valued under a constructivist philosophy where the teacher is not center to the process of learning but rather comes alongside as the encourager, prober, and reflector ultimately assisting in the transformation of knowledge. This also supports experiential learning theory; the debriefing time allows the learner to pause and observe and reflect within the learning cycle. Collaboration like debriefing creates an interdependency of learning and builds on the strengths of all players, producing a more complete reflection at the end of the simulation. Both these variables provide opportunity for the student to deconstruct the thinking involved.

Phase III of the study provided the outcome data. This phase varied the conditions for learning; it involved 403 students. Some students had case studies to work on with paper and pencil, others had a low-fidelity simulation experience, and the third group had a high-fidelity interactive experience. The results of this outcome phase are briefly summarized in Table 3.

Table 3

Results of Phase III of NLN Multi-Site Study

Dependent variable	Case study group paper/pencil	Low-fidelity simulation group	High-fidelity simulation group
Sense of reality	Limited	Limited	Yes
Perception of feedback	No statistical significance; however this group was less likely than		

	the other two to report they received feedback.		
Problem solving opportunities	Reported less	Reported many	Reported many
Collaboration	Yes – high	Limited	Limited
Higher expectations	Yes – high	Did not perceive this	Did not perceive this
Sense of active learning	No	Yes	Yes
Knowledge gain	No significant difference among groups		
Satisfaction level	Average	Average	High
Sense of confidence	Lower	Lower	High
Self evaluation of performance	No significant differences among groups		

The variables that scored significantly higher for the simulation group are not surprising because they are consistent with constructivist philosophy; these variables include: a sense of reality, a sense of active learning, and a sense of confidence in ability to care for a postoperative patient. Creation of reality and active learning are well-established learning principles. The increase in sense of confidence may be seen from students having the opportunity to "do" the interventions and replay it several times. Surprisingly, the variable collaboration scored highest in the paper/pencil group; this implies that though team work is not as effectively experienced in simulation, what is perceived as teamwork by instructors in some studies may simply be "parallel play." A possible explanation is that with paper and pencil testing, a concrete product is expected, forcing collaboration or at least a tangible group outcome. The outcome high expectations was only perceived by students in the paper and pencil group; the research report attributes this to the assumption that students are accustomed to academic rigor when a product must be submitted; however, they are unaccustomed to being evaluated in an apparently less formal manner.

Studies Reviewing the Use of Simulation and Skill Acquisition

Several studies reviewed the development of skill acquisition in simulation. The first by Johnsson, Kjellberg, and Lagerstrom (2005) studied patient transfer technique and the patient's perception of safety during the procedure. This study had a sample size of 71 students, 35 of whom were placed in a control group and the rest in an intervention group. Both groups attended a class on patient transfer; the intervention group then had a simulated experience in which to participate. The study found that students did improve their techniques with use of the simulated patients and also found that the patients perceived a greater sense of safety with the improved work technique.

A second study confirmed these results; this study was conducted using surgical residents and skill acquisition. The study showed improved outcomes with the use of simulation (Issenberg et al., 1999). Within the same article, Issenberg et al., (1999) present a nice synopsis of three skills studies done in the medical literature on simulation training. All of the studies found improvement on skills such as surgical techniques and patient assessment. The first study found in particular the amount of repetition allowed was important, showing that increased repetition led to improved outcomes. Issenberg et al., (1999) points out an additional benefit to students training on simulators was the reduced faculty time involved trying to locate varied patients with the disease processes that are being studied. This is an important consideration as the discipline of nursing education is facing a severe faculty shortage.

In another article, Issenberg et al., (2005) note that performance of a surgical skill is not confined to manual dexterity but is largely a decision-making process. This ideology should presumably translate to nursing also, where students have to select when, how, and where to perform certain skills. An independent study in the Issenberg et al., (2005) review confirmed this ideology showing that residents trained on a simulator first achieved proficiency in fewer attempts at a procedure as compared to those whose training was exclusively performed on humans (Good, 2003). The final study reviewed in this area with positive results was a large study (n=345); the sample included hospital personnel involved in early intervention of potential stroke patients. Hospital personnel were required to attend a one-day interactive training session with the use of simulators.

The study found a significant improvement in clinical skills (including assessment and intervention) at $P<0.0001$. The authors concluded the staff who participated in the simulation training were better prepared for early stroke recognition and management of incoming patients (Gordon et al., 2005).

Two skills studies were found with negative results when training with a simulator. The first skill study (Jeffries, Woolf, & Linde, 2003) used an experimental approach for two groups: a control group was exposed to lecture and case study, and an experimental group participated in a simulation experience. The skill to be learned in this study was performance of a 12 lead EKG test. The study found no differences between the groups, indicating that both groups were satisfied with their instructional method and both were able to demonstrate the skill effectively. The second study was also conducted by Jeffries (2001) and reviewed oral medication administration skills. Again, a two-group experimental condition was set up. The control group watched a video and had a lecture on medication administration; the experimental group watched the video and had an interactive computer assisted instruction (CAI) to complete. Results showed no difference in terms of competency in medication administration; there were, however, differences in cognitive gain and student satisfaction, with the experimental group scoring higher on both counts.

Based on these studies reviewed, it appears that the use of simulation to acquire or improve manual health care skills is promising. The studies that reported no improvement with skills also did not report that skill acquisition decreased or was worse in simulated groups; therefore it appears that the use of simulation and skill acquisition is at minimal equal to gaining skills in the clinical setting.

Studies Reviewing the Development of Team Work in Simulation

Though learning about team work and collaboration is promoted as being a real benefit of simulation, only two studies were found in the literature that looked at this as an outcome measure; unfortunately, the two studies had conflicting findings. The first study (Weller, 2004) involved 33 medical students who were asked to evaluate the use of a simulation-based teaching component of their curriculum. Findings were very positive: 64% of the students identified the development of team work skills as a key learning point in the simulation. In addition, approximately one-third of the students also thought the experience was an excellent way to apply knowledge and were very positive about the simulation, wanting more experiences like it. A supporting study considered the effect of simulation on crisis management skills and teamwork. The study involved surgical residents who were divided into two groups, one group receiving traditional lecture as an intervention and the second group receiving a simulated experience. Results showed almost identical scores on the knowledge obtained during the intervention. However, the simulated trained residents scored significantly higher on crisis management skills and teamwork ($p=0.04$) (Knudson et al., 2008).

The second study (Shapiro et al., 2004) involved interdisciplinary emergency department staff from a local hospital. The subjects received an eight-hour simulation and were compared to a control group who worked an eight-hour shift with interactive education. Results showed no differences in team behavior of the two groups.

A plausible explanation for the conflicting nature of the results could be related to the type of subjects used. The first two studies involved students, whereas the third study was comprised of professional staff; the staff are already socialized into their roles and might not benefit as much as someone learning a new role.

A final study considered only management skills as a subset of team work. This study (Steadman et al., 2006) had a sample of 31 fourth year medical students. A control and experimental group were formed with the control having a problem-based learning scenario and the experimental a simulated experience. The simulated experience proved to be a superior method for learning management skill.

Studies Reviewing Student Confidence Level and Simulation

As seen in Table 1 from the multi-site study, confidence was found to increase in students with the use of simulation. Smaller studies did not find this conclusively; five studies will be reviewed for this measure. Self confidence or self efficacy was frequently measured by self report; the majority of these studies used a qualitative methodology.

Lassater (2007) completed a qualitative study with 48 students who were involved to some degree in a simulated patient experience in lieu of a clinical experience. A general theme that came out of this study was “the paradoxical nature of simulation, that is, provocation of anxious and stupid feelings, yet increased learning and awareness” (Lassater, 2007, p. 273). This is consistent with constructivist philosophy that learning is emotional. As educators, it is important to note that too much emotion can interfere with learning; this is possibly a reason for conflicting results in self-perceived measures in simulation studies. A second study by Schoening, Sitner, and Todd (2006) also looked at student journals for reports on confidence and self efficacy; they report that the confidence category out of four others received the most comments by the students. Students reported feeling more comfortable because the scenario was practiced “over and over" again. Several times, they reported specific measures of confidence, such as "Now I know when to call the doctor" (Schoening, Sitner and Todd 2006, p. 257). A third study was completed with Navy medical personnel (corpsmen) who rarely were exposed to emergent situations; the training given to these men was to maintain underused skills. A small sample size of 18 emergency personnel was used in the pre-test/post-test design. Results showed that human patient simulator training improved self-perceived preparedness and self efficacy; personnel felt they had the opportunity to practice their skills without limitations imposed by time or distance (Treloar, Hawayek, Montgomery, & Russell, 2001). Supporting these reported results was a small study using seven nurse practitioner students who all participated in a simulated intervention and then were asked to complete a knowledge content test and a self reported evaluation. Results from this study showed an improvement in scores on the written test after the simulation ($p=0.019$). On the self reported measure, responses on perceived confidence improved from "somewhat not confident" to "very confident" ($p=0.031$) (Corbridge et al., 2008).

In contrast, the next two studies reviewed reported no differences in confidence levels of students after simulation experiences. The first study (Alinier et al., 2006) was completed in the United Kingdom with a large sample size of 344 nursing students. This study was conducted using a pre-test/post-test design. Experimental and control groups were formed. Both groups were exposed to the regular curriculum; the experimental group had an additional simulation experience. Findings showed a statistically significant increase in the confidence scores on the exams of the experimental group. After the initial findings, both groups were placed back in patient care settings for a clinical experience and retested afterward. Perceptions of stress and confidence were equal for both groups.

The next study measured self efficacy. This was a smaller study with a sample size of 23 (Madorin & Iwasis, 1999). Again, two groups were used; this time, the experimental group completed an interactive CAI. Self-efficacy scores were measured pre- and post-intervention. The study found a statistically significant increase in self efficacy after the CAI completion. This is consistent with Bandura's (1977) assertion that self efficacy increases with performance completion. Like the United Kingdom study, this study remeasured self efficacy after both groups completed eight weeks of clinical experience. At this later time, there were no differences between the scores of the two groups. Unfortunately, no studies were found investigating how fast self efficacy or confidence is developed in simulation versus clinical experiences.

Studies Reviewing Transferability of Simulated Learning to the Clinical Setting

If the learning in the simulation lab were not transferable to the clinical setting, then any efforts in this area would be futile. As the literature base is building, several scholars are asking: Is simulation learning valid and transferable? First the Schoening, Sitner and Todd (2006) study will be reexamined for its findings on transferability. Again, this was a qualitative study where the researchers reviewed student journals after a clinical experience. A general strand that was found was learning was highly effective and efficient and that students felt more comfortable going into the clinical setting. Some statements regarding transferability taken from the journals include: "I learned three times more in the laboratory;" "It incorporated many valuable experiences into a short time;" "very effective teaching method;" "very good idea to implement in every rotation;" "helped me in my clinical experiences" (Schoening, Sitner and Todd, 2006, pp. 256-257). These results are consistent with the Madorin's (1999) study that showed students had a higher sense of self efficacy early on as they went into the clinical experiences. It was concluded that students who had a simulation experience prior to entering the clinical setting were able to function at a higher level of nursing practice in the clinical setting.

A study by Feingold et al.,(2004) supports the idea of transferability particularly from a faculty perspective. Feingold et al., (2004) studied faculty and student perceptions of learning in the simulation laboratory. Using descriptive statistics, the study found 100% of the faculty believed students acquired skills that would be transferable to the clinical setting. Interestingly, the students disagreed, with less than half of them (47%) feeling like they had more confidence after the simulation and only 55% believing the simulation prepared them for the real world. The authors discuss the discrepancy in this finding as possibly being related to the different perceptions of novices and experts, where novices are focused on small, individual tasks and the experts are able to view the larger picture.

Lassater's (2007) study was generally supportive of the transferability of practice from the simulation lab to the clinical setting. However, she did articulate some very specific limitations that simulation has to transferability from the laboratory into the clinical setting. These include: the human patient simulator always had a female voice, even if the patient in the scenario had a resection of the prostrate gland, for example. There were no visual cues by the simulator such as smiles or grimaces which the students found difficult, citing that 75% of communication is non-verbal. Also, there were limitations in physical assessment skills that the simulator could mimic, including reflexes, swelling, active bleeding, and color changes.

In their 2006 article, Bligh and Bleakley discussed the state of simulation; in particular, they questioned the transferability of learning: “The simulation community becomes fascinated by the possibility of technology-driven learning losing touch with the real environment the simulated setting once copied” (p. 610). They go on to say that interpersonal skills and team work are best learned in simulation; however, psychomotor skills are hampered by the inability to transfer the learning into the real environment. For example, the insertion of a urinary catheter on a manikin is an emotionally and psychologically different experience in the simulation lab than the repeating the procedure on a live person.

The final article reviewed on transferability measured clinical practice parameters after a simulation experience. Within the study, several categories were considered: safety, basic assessment skills, problem-focused assessment and ensuing interventions, delegation and communication. This was also a small study including only 12 senior students. In general, it was found that students who practiced with the human patient simulator had higher scores than the control group; however, statistically significant increases were found only on the areas of patient identification and assessing vital signs. Assessment, communication, and delegation measures remained the same between the two groups. The researchers explained this lack of differentiation as not related to lack of transferability but rather related to not emphasizing these areas in the debriefing sessions (Radhakrishnan, Roche, & Cunningham, 2007).

Studies Reviewing Clinical Simulation and Critical Thinking

The multi-site study by Jeffries (2006) showed no differences in knowledge gain between the groups of zero, minimal, and high-fidelity simulation. Jeffries states: “This is not a surprising finding, however, since students were not expected to acquire new knowledge during the experience. The simulations were designed to give them an opportunity to apply their knowledge; learning with simulation should be directed towards synthesis and application of knowledge, rather than new knowledge development" (2006, p. 8).

Knowledge application would be the general consensus of the simulation community. Learning outcomes need to be analyzed at Bloom's (2008) application level or higher (Ming, Osisek, & Starnes, 2004). Not surprisingly several studies have measured this level of learning with use of variables such as critical thinking or clinical judgment.

Beyea, Von Reyn, and Slattery (2007) used 42 nurse residents (new graduate nurses) during their orientation time to a registered nurse position. Clinical judgment was both self reported and evaluated by observation of experts. The findings were consistent. The residents felt like they were utilizing critical thinking skills; the experts cited that decisions were made fast and by thinking on the fly, and they believed the new graduates demonstrated critical thought. An end result of this study showed orientation time for new graduates to a medical surgical floor to be decreased from an average of 26 weeks to 14.74 weeks.

Critical thinking was also tested with the human patient simulator in a study by Rhoades and Curran (2005), the study sample included senior level nursing students. The experience was measured by anecdotal statements from both the students and the faculty. Among both evaluators there was consensus in that critical thinking improved and was effectively utilized in the scenarios.

Lassater's (2007) qualitative study was initially designed to consider the development of clinical judgment. The clinical judgment was evaluated two fold again, by self report from the students and observation from the faculty. The strongest finding in this study was that it brought "everything together" such as the theoretical bases from the classroom and readings, the psychomotor skills from the laboratory, and the human issues of communication. One student recorded: "You had to actively work through the issues integrating all the learning" (Lassater, 2007, p. 272). Studies also consistently report that students have an increased level of self confidence as they practiced integrating the information required in patient care (Parr & Sweeney, 2006; Wolf, 2008). In simulation, time is suspended allowing the beginning student to think critically before making decisions. The Wolf (2008) study was interesting because it reported that more experienced nurses showed the least improvement in confidence after simulation; the experienced nurses had difficulty with the "artificialness" (p.171) of the simulation; these nurses were used to looking for patient cues such as facial expression, muscle tone, and changes in skin color. These factors are not difficult for the novice nurses perhaps because they were looking for less subtle cues.

A final study reviewed considered the effect of simulation on clinical decision making of midwifery students (Cioffi, Purcal, & Arundell, 2005). This was a pilot study with a sample size of 36 that were divided into control and experimental groups; simulations were delivered to the experimental groups in place of lecture at different times during their two-year course of study. Overall, the results showed that students who received the simulation intervention arrived at clinical decisions more quickly than students. In addition, the breakdown of the results also showed that the simulation students collected more data, they revisited the data less frequently in the decision-making process, and they more readily made inferences from the data collected. Not surprisingly, the simulated group also reported higher levels of confidence. The study concluded tentatively that simulations can positively affect the decision making process among midwifery students.

Meta Analyses of Quantitative Studies Related to Computer-Based Simulation and Health Care Education

Two meta analyses reviewing simulation studies were found; one was from the nursing literature and the other from the medical literature. The nursing study by Ravert (2002) was an attempt to complete an integrative review of all the studies done on computer simulation in health care. With the use of six data bases (CINAHL, Medline, EMBASE, Health star, Aerospace DBASE, and ERIC), 105 articles were identified. Unfortunately, only nine of those identified fit the inclusion criteria for the study. Five of the articles were from medical schools; the design of these five studies looked at knowledge gain. Four of the studies favored simulation as a pedagogical approach for cognitive development. Simulation is not typically not being tested as a mode for knowledge gain (Jeffries, 2006), and unfortunately the instruments used to measured cognitive development in these studies were not described in depth; it would be noteworthy to see what level of Bloom's taxonomy (2008) the instrument was utilizing. The study that did not favor simulation compared students in a simulation group to a seminar group; knowledge gain was greater in the seminar group. This is consistent with the findings from simulation studies that emphasize students' perception of learning was greater during the debriefing sessions. A good seminar in many ways can mimic a debriefing session, allowing discussion, theory-based ideas, uncovering assumptions, and more.

The remaining four studies reviewed were from nursing journals with all of them having favorable outcomes for simulation. The nursing studies in comparison to the medical dealt with learning assessment skills. Ravert (2002) concludes this disappointing small review with “the studies reviewed represent an attempt to document the effect of computer-based simulation on knowledge and skill acquisition. However, strong conclusive studies were lacking” (p. 207).

In 2005, Issenberg, McGaghie, Petrusa, Gordon, and Scalese reviewed the simulation literature in the medical profession, and they were more successful in finding 109 studies that addressed education and simulation. They concluded that high-fidelity simulation is educationally effective and should be used to complement medical education. In particular, they reported that 47% of the journals reviewed show that educational feedback is the most important feature in medical education consistent with the debriefing feature in nursing. Also, 39% of the articles identified repetitive practice as a key feature in the success of high-fidelity simulations; 25% of the articles identified that simulation-based experiences need to be integrated into standard curricula for effective use. All other findings were consistent in less than 10% of the articles and will not be reported here. Issenberg et al., (2005) did conclude with “high-fidelity simulations facilitate learning among trainees when used under the right conditions” (p. 10). The top conditions reported include: feedback, repetition, integration with overall curriculum, and increasing level of difficulty all these conditions are congruent with constructivist philosophy.

Literature Review Summary

After completing the review of literature, it appears that simulation in education has been more vigorously studied in medicine, as compared with nursing. The medical studies were typically larger and quantitatively based, while the nursing studies often had small numbers and frequent measures were self-reported feelings of competence or comfort level with skills. The question to consider is: Are the medical studies completely transferable to nursing? One limitation here may be level of students, undergraduates compared to graduate students. Also, in the medical literature, there was a large emphasis on simulation being used specifically in the intricacies of manual dexterities in high-level skills. In nursing, the number of skills is much more limited; the skills tend to be easier and less life threatening if error occurs. It appears in the medical literature that the simulators have a very specific place (skill acquisition); in the nursing literature, this place is broader, from skills to assessments to clinical decision making, to entry-level competence.

In general, all the studies reviewed reported positive perceptions from the subjects, that simulation was a valid tool and was a pleasurable learning experience (Kiat, Mei, Nagammal, & Jonnie, 2007). Though the field of simulation is wide open in nursing education and perhaps only as limited as the imagination and creativity of the faculty (Nehring, 2001), the pros and cons for use of simulation must be considered. One big concern to the profession is the dehumanizing of patients when learning is completed on a simulator. Nursing by definition is the "human response to illness;" to diminish the human in the educational process is disturbing to many. On the other hand, as Issenberg et al.,(1999) clearly point out, simulation training avoids using patients for practice and ensures that students come into the clinical world with some exposure to real problems before treating human beings. Weingarten (2005) notes that in pilot education, a pilot's first flight in an airplane may not be until after he graduates. Most nurse educators are not ready for this to happen in nursing education since nursing is a human practice and simulation has limitations in its ability to mimic human responses. Instead, in nursing education, simulation is perceived as a bridge between the classroom and the clinical setting and as a safe place to remediate error (Beyea et al., 2007).

Concluding Remarks

It is important to remember that simulation is another pedagogical approach to instruction. Simulation cannot run itself; it must be purposefully designed and anchored in established learning theory. Like any instructional method, effectiveness of the approach is influenced by skilled faculty implementing the design and adjusting the approach as needed to its learners.

The June 2008 issue of the *Nurse Educator* journal's lead article is entitled "Using non-faculty registered nurses to facilitate high-fidelity human patient simulation activities" (Foster, Sheriff, & Cheney, 2008). This prestigious journal is promoting simulation as a prescriptive approach to education that can be facilitated by any nurse. The prescription is to program scenario A to meet objective A, and scenario B to meet objective B, and so on. There is no regard for learner differences in level, style, or background. The assumption is that all learners have the same learning need and will learn in the same manner. This is a classic example of the disconnect between theory and the practice of nursing education within the discipline; unfortunately, this is in a leading journal. Winn (1997) addresses this situation in his article and stresses the danger in the use of “unfettered pursuit of prescriptions” (p. 35) where facilitators use a prescriptive approach to teaching, much like what they are suggesting in the nursing article. The assumptions tied to this approach are that learners are predictable and think logically and therefore fall easily into a cascading series of learner responses.

Nursing education is a specialty branch within the discipline of nursing; nurse educators need an understanding of educational theory to compensate for the fallibility inherent in all instructional design procedures. Nurse educators need to think for themselves and be able to use the principles of learning theory to promote learning outcomes during interaction with their varied students (Winn, 1997). For this to happen there needs to be an integration of the disciplines of education and nursing, this study will contribute to that integration.

From the review of literature it is evident that many of the studies on simulation in nursing education have been published in the last five years. Unfortunately, the majority of these studies involved small, homogeneous samples whose ability to be generalized is limited. The few studies done on a larger scale provide suggestions for follow-up studies and continue to call for further research. This study responds to the call and will contribute to the literature in particular in the very bare researched area of pediatric nursing simulation.

CHAPTER III

METHODOLOGY

"Too often many appear to forget that the simulator does not train. It is the manner in which the simulator is used that yields its benefit." — P. Caro

Methodology

This study used a classic experimental approach, which involved the following components: (1) independent and dependent variables; (2) pre- and post-testing (3) experimental and control groups and (4) randomization (Babbie, 2007).

Independent Variable: Educational Experience

There were two levels of the independent variable as follows: (1) six days of clinical experience at a Midwestern children's hospital, and (2) four days of clinical experience at a Midwestern children's hospital along with two days of simulated pediatric experience in the simulation laboratory, resulting in a 20/80 simulation/clinical mix.

Dependent Variable: The Nursing Care of Children ERI Exam

The student score set on the nursing care of children educational resources exam (peds ERI) served as the dependent variable for all study subjects. The exam was made up of four components including nursing process, client needs, critical thinking and pediatric topics. Each component had multiple levels of repeated measures as follows:

1. Nursing process (five levels): assessment, analysis, planning, implementation, and evaluation.

2. Client needs (four levels): safety, health promotion, psychosocial integrity, and physiological integrity.

3. Critical thinking (six levels): prioritizing/discriminating, inferential reasoning, interpretive reasoning, goal setting, application of knowledge, and evaluating predicted outcomes.

4. Pediatric topics (seven levels): adolescents, child development, wellness/illness, infant, toddler, preschool, and school-aged.

Pre- and Post-Testing

The peds ERI exam (2008) was given at two points during the semester. The pre-test was administered at the beginning of the semester prior to any theory or clinical courses; the post-test was given at the close of the semester after all the courses had concluded. Two alternate forms of the test were used. Test form A was given as the pretest and test form B was given as the posttest.

Measure: Pediatric ERI Exam

The peds ERI exam was chosen as the instrument of measure for multiple reasons as follows. The exam is used to measure clinical practice in nursing school curriculum; it has established validity and reliability measures; and there is a significant correlation ($r=0.15$ at 0.01 level of significance) between passing any of the Educational Resources Incorporated exams (ERI) and the national state board licensing exam (NCLEX) (2008) for registered nurses.

The ERI exams are clinical-content specific and are typically given at the end of the semester after completion of clinical rotations. For example, in the university where the study is being conducted, medical surgical and pediatric clinical experiences are offered in the fall of the junior year; at the end of the semester, students are required to take a medical surgical ERI exam (2008) and a pediatric ERI exam (2008). Many schools of nursing use the different ERI exams each semester as a formative evaluation to determine student risk on the state board examination (NCLEX). The NCLEX exam (2008) is a measure of safe practice for students testing to become registered nurses; this exam is comprehensive of all areas in nursing (such as psychiatric, obstetrics, medical surgical). The peds ERI exam (2008) is a measure of one area of nursing and tests entry-level safe practice in the pediatric clinical setting only.

The peds ERI exam (2008) has undergone extensive reliability and validity testing. The peds ERI (2008) last went through reliability testing in 2006 with 500 sets of student scores. For the peds ERI exam (2008), the two forms tested had Chronbach Alpha reliability coefficients of 0.89 and 0.86, respectively (Simmons, 2006). During the reliability testing, the questions are strengthened using the point biserial correlations. Negative point biserials are reviewed for accuracy, clarity, content, and appropriateness for the clinical area of concern. It is the ERI policy that any exam with less than a 0.8 reliability coefficient will receive careful review (Simmons, 2006).

Multiple sources are used to establish validity of the ERI exams. Content validity is established by nursing content experts who are abreast with current guidelines of state and professional licensing. Question clarity is ensured through the ongoing editing of items with item analysis. Each question is designed to discriminate nursing process and content. Construct validity is completed annually by content experts. The test plan is guided by the current national licensing exam (NCLEX) plan (Simmons, 2006).

Finally, this is an appropriate measure to evaluate entry-level safe practice because of the strong predictive ability it has for success on NCLEX (2008). Entry into nursing practice in the United States is regulated by the NCLEX exam (2008) to ensure public safety. Successful completion of this exam shows that the student has met the minimal criteria to practice safe and effective nursing care. Since nursing is a practice profession, the majority of items are written at the application or higher levels of cognitive ability (National Council of State Board of Nursing, 2008). The most recent study on the predictive ability of the ERI exams was completed in 2007, and 3,352 student scores were reviewed on an exit ERI exam. Cronbach Alpha for this exam was 0.93. The correlation of the peds ERI with NCLEX outcomes was significant at the 0.01 level (Simmons, 2006).

Simulation Design

The simulation was designed by the investigator to mimic the clinical learning experience as much as possible (see Appendix B). Each student in the simulation group completed two shifts in the simulation lab; like in the clinical setting, the student received a different patient for each shift. Students in the simulation group had a 20/80 simulation/clinical mix learning experience. The objectives of the clinical course served as general objectives for the simulation; they, however, were made more specific after conferencing with the individual students involved in the simulation.

The simulation group was required to complete the same paperwork as the clinical group. In the clinical setting, the student meets the patient and then has an opportunity to spend about an hour working on a preliminary care plan; this was copied in the simulation setting. Appendix A shows the paperwork the students completed, this included the clinical preparation form (after meeting the patient), the nursing care plan form, and the journal (after the simulation experience).

Scenarios

The investigator developed two scenarios that covered respiratory and cardiac disease (Appendix B). Students in the clinical condition were only included in the study if they also had an opportunity to work with a respiratory and cardiac patient, this ultimately included all students in the clinical condition since respiratory and cardiac disease are the biggest causes of hospital admissions in children and every student in the clinical setting had an opportunity to work with these diagnoses.

Each simulation was run with four students playing different roles as recommended by Jeffries (2006). This ratio of student to faculty was left at 4:1 for this research; a smaller ratio would be impractical for nursing schools to integrate into their programs. The roles recommend by Jeffries (2006) were of two types: participants and observers. In the simulation intervention these roles were rotated as students completed the different simulations.

Each simulation was videotaped and reviewed by the students and the researcher before being destroyed. For each simulation, a debriefing guide was given to help direct the thinking and ensure that the critical content points of care delivery were covered.

Data Collection

Appropriate steps were taken to gain admittance to the junior nursing class at Oklahoma Baptist University (OBU); a letter of intent was sent to the dean of the school of nursing and to the OBU human subjects committee. Full permission was received by the dean to conduct the research in the school of nursing and permission was also received from the human subjects committee at OBU. The class was informed of the study during their orientation day at the beginning of the semester (see script Appendix D).

All junior nursing students enrolled full time in the program at OBU were invited to participate; all who agreed signed the consent form (Appendix C). The consent form included the study's purpose, benefits, and risks. The consenting students were then randomly assigned to either the clinical or the simulation group. Randomization was done by first mixing all the students' names and assigning each a number that had been generated by the computer; numbers 1 through 28 were assigned to the simulation group, and numbers 29 through 57 were assigned to the clinical group. All study participants completed the pre-test prior to their assigned clinical rotations; the resulting data was used to look for any differences on onset of the study between the groups. Following the pre-test, the clinical group attended clinical as normally assigned. The simulation group subjects signed up for two shifts in the simulation lab and their clinical instructors were notified to dismiss these students from the equivalent hours in the clinical setting. At the close of the semester all students completed the post-test. The scores of the subjects were then entered into an SPSS computer program; all identification information was deleted for the study's analysis.

Analysis

Four mixed model analysis of variances were used as the statistical approach to analyze the data. This approach was chosen because as described there were four component scores each with multiple measures, each of the repeated measure were scored on the same scale. This was mixed design with a between and within component. The within group component was the repeated measures and the between component was group. The alpha level of significance for the study was set at 0.05; this was chosen because the risk of committing type I or II error is not life threatening; this alpha level is a typical level of significance for behavioral/educational type studies (Shavelson, 1996). The study was designed to meet the requirements and assumptions of the tests listed below:

Design Requirements (Shavelson, 1996)

1. There are two independent variables (group and repeated measures), each with two or more levels which exhaust the interest of the researcher.
2. The levels of the independent variable differ quantitatively or qualitatively (simulation is a 20/80 mix whereas clinical is a 0/100 experience).
3. The levels of one factor are randomly sampled (group).

Design Assumptions (Shavelson, 1996)

1. Independence – the score for each subject is independent of the score for any other subject. Students completed the Peds ERI exam (2008) independent of each other.
2. Normality – the scores within each treatment population are normally distributed, or they are sampled from a population of scores that are normal in form. There were > 12 subjects in each condition.
3. Homogeneity of variance – the variance of scores in each population is equal. Levene's test (Keppel and Wickens, 2004) was conducted to confirm this assumption.
4. Homogenity of covariance – A Box M test was completed (Keppel and Wickens, 2004)
5. Sphericity – covariance matrixes are spherical and are the same across groups. The Hunyh-Feldt epsilon (Keppel and Wickens, 2004) was considered.

Ethical Considerations

The Oklahoma State Institutional Review Board reviewed the study to ensure that the following was been considered: respect for person, beneficence for all, and justice in sample selection. Since this was research that was conducted in an educational setting and involved normal educational practices, the study received an exempt status consistent with the Oklahoma State University research guidelines that report: "Research activities conducted for educational purposes usually do not fall within the definition of research as defined by the regulations governing human subject research" (http://compliance.vpr.okstate.edu/hsp/documents/IRB%20Guide%206-08.pdf).

There was "no risk" (physical, psychological, or social) to the subjects as this was simply an educational strategy in the classroom, and no special populations were used. The study had no effect on the students' grades. A copy of the consent form can be seen in Appendix C.

In addition to the approval obtained from Oklahoma State University, the human subjects committee at Oklahoma Baptist University also approved the study to be ethical and appropriate to be conducted on their campus.

CHAPTER IV

FINDINGS

This chapter will open with a presentation of the sample obtained; this will be followed by reliability and validity testing of the instrument. The four study questions will then be reviewed and the results of the study will be presented. The effect size of significant effects will follow.

Sample

The population sampled in this study included all junior nursing students enrolled in a pediatric clinical course at one small Midwestern university. The enrollment in the course at the start of the semester was 57. All students were offered an opportunity to participate in the study; of these students one refused to participate. By the conclusion of the semester, five consenting students were dropped from the study for different reasons including: dropping the course, changing to part-time status in the nursing program, and not completing the required number of practicum hours for the course. This left a sample size for the study of 51; 26 of these students had been randomly assigned to the control group, and the other 25 to the simulation group.

Reliability and Validity Testing of the Instrument

The reliability of the instrument was tested using the collected data. At the beginning of the study the educational resource company reported reliability on the pediatric ERI as 0.86 (Simmons, 2007). Unfortunately the computed reliability for the study data was much lower, demonstrating an alpha coefficient of 0.465. This is a large discrepancy from the reported reliability of the instrument. This difference is attributed to two main causes: firstly, the study sample was 51 compared to the company's sample that is reported as a minimum of 500 students, with this decrease in sample size a decrease in the Alpha coefficient is expected. Secondly during the course of the study the educational resource company was purchased by another testing company who is now in the process of retiring many of the original ERI products. The original sources for reliability reports were no longer available after the study was completed and the new company was unfamiliar with the test used in this study, it appears that the quality control on the exam was not in place after the sale of the original company.

In light of the poor reliability score received the researcher wanted to validate the validity of the exam. Correlations between the pre and post test scores were computed to see whether students consistently scored low or high on each test. The correlations are summarized below.

Table 4

Pearson Correlation Between Pre- and Post-Test Scores

	Pearson correlation	Significance (2 tailed) *(significance at 0.05 level)
Nursing process: Assessment	0.291	0.039*
Nursing process: Analysis	0.320	0.022*
Nursing process: Planning	0.312	0.026*
Nursing process: Implementation	0.233	0.100

Nursing process: Evaluation	0.275	0.051*
Client needs: Safety	0.224	0.114
Client needs: Health promotion	0.379	0.006*
Client needs: Psychological	0.222	0.117
Client needs: Physiological	0.334	0.017
Critical thinking: Prioritization	0.598	0.076
Critical thinking: Inferences	0.376	0.007*
Critical thinking: Interpretive	0.113	0.429
Critical thinking: Goal setting	0.029	0.840
Critical thinking: Application	0.247	0.080
Critical thinking: Outcomes	0.153	0.284
Pediatric topics: Adolescent	0.191	0.179
Pediatric topics: Development	0.184	0.197
Pediatric topics: Wellness	0.395	0.004*
Pediatric topics: Infant	0.293	0.037*
Pediatric topics: Preschool	0.444	0.001*

Pediatric topics: School aged	0.407	0.003*
Pediatric topics: Toddler	0.082	0.568

Ten of the measures had significant correlations suggesting that on these items the test consistently measured low- and high-scoring students across tests. With less than 50% of the measures showing significant correlations the validity of the instrument also appears to be poor. However, the researcher noted that on the pre-test there was no class grade assigned to the score; therefore several of the students appeared to take the test casually. The post-test score, in contrast, was important to the students because it impacted whether they would have to take a review course the following year; the post-test was taken very seriously. The attitude of the students could have impacted the correlations between the two tests.

To summarize the testing of the instrument yielded results that showed it to have poor reliability and validity measures. The results of the study therefore are interpreted in light of a poor instrument and are understood to be a major limitation of this study.

Study Design and Analysis

A classic experimental approach was used for the study, subjects were randomly placed in one of two groups: simulation or clinical. The independent variable for the study was the educational instruction received by the students, the variable had two levels, the first being a mix of simulation and clinical (20/80) and the second level was a 100% clinical approach. At the conclusion of the pediatric clinical course the two groups were compared with the use of a post test.

Much consideration was given to the use of a multivariate approach versus a univariate approach. The final decision to conduct a univariate analysis was one of maximizing power of the statistical test for the relatively small sample. Stevens (2004) reports: “as a rough rule of thumb, we would suggest that the multivariate approach should probably not be used if n is less than a +10 (a is the number of levels of repeated measures)” (p.509). For this study, n was 25 and a+10 was 32; therefore, Stevens would not recommend the multivariate approach. In addition, with a high number of dependent measures and a small sample size, the typical power of the multivariate test is minimal and in fact compared to the univariate test is insignificant (Stevens, 2004). Finally in this study, the assumption of sphericity held, therefore, the univariate test maximizes power as compared to its multivariate counterpart (Stevens, 2004).

Four component scores of the dependent variable were analyzed, these included nursing process, client needs critical thinking and pediatric topics. The within component of the design in each case were the repeated measures and the between component was group (simulation or control). This resulted in the general linear model for each test as: repeated measures by group.

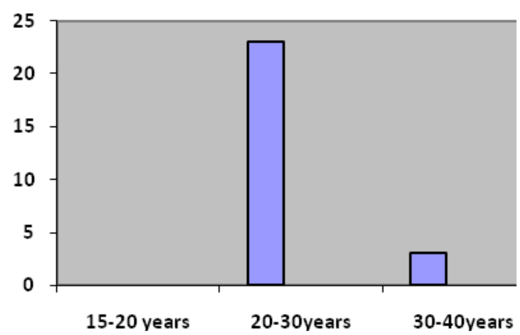
With any repeated measures analysis, the main reason for within group variability is individual differences among the subjects. To assess whether the groups were alike, demographic variables were compared (see figure 3). In both groups 88% of the subjects were between the ages of 20 and 25; this was consistent for the ethnicity variable with 88% of both groups identifying themselves as Caucasian; finally in each group there was one male, the rest of the subjects were females.

In addition to the subjects being randomly assigned to each group a pre-test was given to ensure that the groups were alike at the start of the experiment. A t-test showed that there were no significant differences in Peds ERI (2008) score, at the alpha 0.05 level between the clinical and simulation groups at the beginning of the experiment.

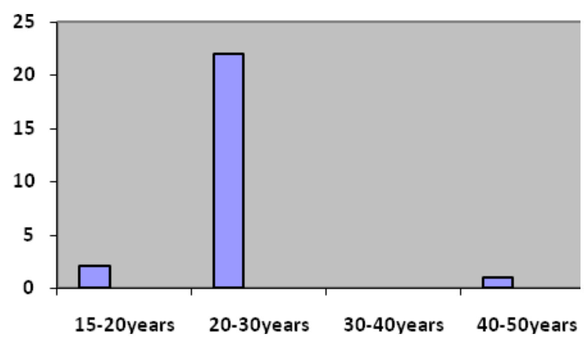
Figure 3

Demographics of the control and experimental groups

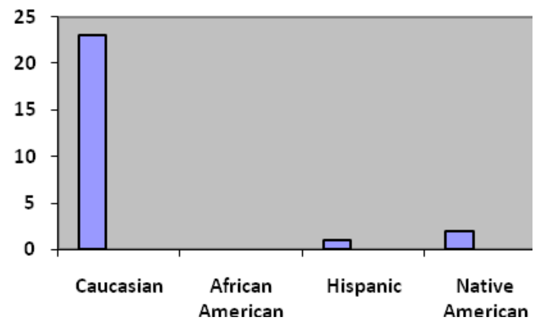
1 Control group: Age



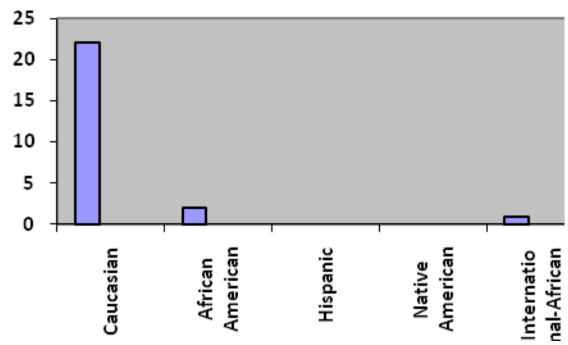
2 Experimental group: Age



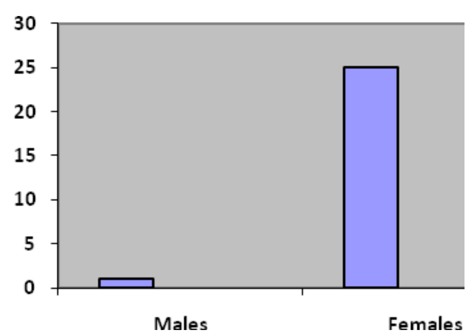
3 Control group: Ethnicity



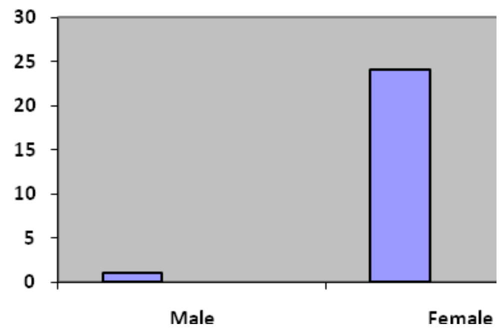
4 Experimental group: Ethnicity



5 Control group: sex



6 experimental group: Sex



Post Test Analysis

All subjects completed the posttest as prescribed; there were no missing data points for the analysis. In addition for each of the four ANOVA's all the assumptions of the statistical test were met (See Appendix E).

Study Question 1: How is entry-level safe practice in the nursing process affected by simulation versus clinical experiences?

There were five levels of the dependent variables for this category resulting in a general linear model for this analysis of assessment, analysis, planning, implementation, and evaluation by group.

Table 5

Descriptive Statistics

Group		Mean	Standard Deviation
Assessment	Control	51.08	9.79
	Simulation	49.92	11.08
Analysis	Control	64.31	13.93
	Simulation	63.80	14.61
Planning	Control	54.88	7.399
	Simulation	56.68	15.47
Implementation	Control	52.42	10.53
	Simulation	53.72	7.41
Evaluation	Control	55.46	13.77
	Simulation	54.96	12.46

There was no significant interaction effect when nursing process was crossed with group as shown below in the ANOVA source table 6.

Table 6

ANOVA Source Table for Nursing Process

Source	Sum of squares	df	F	Significance
Nursing Process	5301.703	4	9.968	0.000
Nursing process X group	83.883	4	0.158	0.959
Error (within)	260601.681	196		
Group	2.186	1	.012	0.913
Error (between)	8936.245	49		

Since there was no interaction effect the main effects were considered next. The main effect for group membership showed no differences, suggesting that the nursing process score was alike for both the control and simulation groups. The main effect for nursing process however did show significant differences, suggesting that among the levels of the variable for both groups together there were significant differences. In order to further investigate these differences a post hoc analysis was conducted using the Fisher LSD (least squared difference) approach, this approach is beneficial because it has a high power to detect differences with a controlled family wise error rate (Keppel and Wickens, 2004).

Table 7

Nursing Process: Pairwise comparisons of significant main effects

	Assessment	Analysis	Planning	Implementation	Evaluation
Assessment		.000	.010	.192	.020
Analysis			.006	.000	.002
Planning				.223	.785
Implementation					.785
Evaluation					

The comparison for the main effect of the nursing process repeated measures demonstrate that assessment and analysis measures were significantly different from all the others. The descriptive statistics show that analysis has the highest mean in the group of 64.059 and that assessment has the lowest mean in the group of 50.510, the other three measures are grouped between the two extremes showing no significant differences between them.

Study Question 2: How is entry-level safe practice in the area of patient need identification affected by simulation versus clinical experiences?

There were four levels of the independent variables for this category resulting in a general linear model for this analysis of safety, health promotion, psychological, and physiological by group.

Table 8

Descriptive Statistics

Group		Mean	Standard Deviation
Safe	Control	51.69	10.58
	Simulation	49.32	12.21
HP	Control	59.58	11.74
	Simulation	54.96	15.60
Psy	Control	46.92	13.79
	Simulation	47.20	9.36
Phys	Control	55.31	6.52
	Simulation	58.16	5.62

There was no significant interaction effect when the variable patient needs was crossed with group as seen in the ANOVA source table 9.

Table 9

ANOVA Source Table for Client Needs

Source	Sum of squares	df	F	Significance
Needs	3752.144	3	11.732	0.000
Needs X group	400.595	3	1.253	0.2930
Error (within)	15670.964	147		
Group	47.474	1	0.268	0.607
Error (between)	8686.065	49		

Since there was no interaction effect the main effects were considered next. The main effect for group membership showed no differences, suggesting that the client needs score was alike for both the control and simulation groups. The main effect for client needs however did show significant differences, suggesting that among the levels of the variable for both groups together there were significant differences. In order to further investigate these differences another Fischer LSD analysis was conducted (Keppel and Wickens, 2004).

Table 10

Client Needs: Pairwise comparisons of significant main effects

	Safety	Health Promotion	Psychological	Physiological
Safety		.006	.067	.000
Health Promotion			.000	.777
Psychological				.000
Physiological				

The post hoc comparisons for the main effect of repeated measures show that the measures safety and psychological are similar and the measures health promotion and physiological are similar, any other combination of comparisons show significance. The descriptive statistics show that safety and psychological means are low (50.52 and 47.05) in comparison to health promotion and physiological which both have high means (57.31 and 56.70).

Study Question 3: How is entry-level safe practice in the use of critical thinking affected by simulation versus clinical experiences?

There were six levels of the independent variables for this category resulting in a general linear model for this analysis of prioritization, inferences, interpretations, goal setting, application, and evaluation by group.

Table 11

Descriptive Statistics

Group		Mean	Standard Deviation
Prioritization	Control	53.19	10.33
	Simulation	52.24	13.46
Inferences	Control	53.85	19.61
	Simulation	58.68	16.84
Interpretive reason	Control	61.15	15.05
	Simulation	62.80	14.86
Goal	Control	59.00	11.31
	Simulation	61.60	11.35
Application	Control	50.85	11.15
	Simulation	51.52	9.85
Evaluation	Control	54.65	14.50
	Simulation	54.24	15.65

There was no significant interaction effect when critical thinking was crossed with group as seen in the ANOVA source table 12.

Table 12

ANOVA Source Table for Critical Thinking

Source	Sum of squares	df	F	Significance
Critical thinking	4616.294	5	5.172	0.000
Critical thinking X group	288.582	5	0.323	0.899
Error (within)	43734.314	245		
Group	149.443	1	0.540	0.466
Error (between)	13554.563	49		

Since there was no interaction effect the main effects were considered next. The main effect for group membership showed no differences, suggesting that the critical thinking score was alike for both the control and simulation groups. The main effect for critical thinking however did show significant differences, suggesting that among the levels of the variable for both groups together there were significant differences. In order to further investigate these differences the Fischer LSD post hoc analysis was conducted.

Table 13

Critical thinking: Pairwise comparisons of significant main effects

	Prioritization	Inferences	Interpretive	Goal	Applications	Evaluation
Prioritization		.247	.000	.001	.499	.536
Interpretive			.068	.106	.062	.564
Interpretations				.531	.000	.013
Goal					.000	.021
Application						.206
Evaluation						

The post hoc comparisons for the main effect of critical thinking show significant differences between the measures of interpretive reasoning, goals and application. Interpretive reasoning and goals are separated from the group with high means of 61.961 and 60.275 respectively; application has the lowest mean of 51.176. The other three measures are grouped between these extremes.

Study Question 4: How is entry-level safe practice in pediatric topics affected by simulation versus clinical experiences?

There were seven levels of the independent variables for this category resulting in a general linear model for this analysis of adolescent, development, wellness, infant, preschool, school age, and toddler by group.

Table 14

Descriptive Statistics

Group		Mean	Standard Deviation
Adolescent	Control	66.92	17.83
	Simulation	62.40	22.59
Development	Control	41.54	16.89
	Simulation	40.00	11.54
Wellness	Control	53.81	7.78
	Simulation	56.12	6.566
Infant	Control	51.35	10.09
	Simulation	49.60	13.13
Preschool	Control	47.46	28.71
	Simulation	43.96	31.62
School age	Control	67.27	14.67
	Simulation	69.56	13.73
Toddler	Control	50.42	15.43
	Simulation	49.76	11.91

There was no significant interaction effect when pediatric topics were crossed with group as seen in the ANOVA source table 15.

Table 15

ANOVA Source Table for Pediatric Topics

Source	Sum of squares	df	F	Significance
Topics	30213.233	6	17.274	0.000
Topics X group	527.788	6	0.302	0.9362
Error (within)	85702.957	294		
Group	98.876	1	0.270	0.606
Error (between)	17963.516	49		

Since there was no interaction effect the main effects were considered next. The main effect for group membership showed no differences, suggesting that the pediatric topics score was alike for both the control and simulation groups. The main effect for pediatric topics however did show significant differences, suggesting that among the levels of the variable for both groups together there were significant differences. In order to further investigate these differences a post hoc analysis was conducted.

Table 16

Pediatric Topics: Pairwise comparisons of significant main effects

	Adolescent	Development	Wellness	Infant	Preschool	School Age	Toddler
Adolescent		.000	.002	.000	.000	.248	.000
Development			.000	.000	.290	.000	.001
Wellness				.019	.036	.000	.019
Infant					.265	.000	.861
Preschool						.000	.374
School Age							.000
Toddler							

The pairwise comparisons show that the measures adolescent and school aged differ significantly on every measure except with each other. In addition development differed on every measure except with preschool. Descriptive statistics show adolescents and school age children as having the two highest means (64.70 and 68.39), development has the lowest mean at 40.78. The other measures are grouped together between these two extremes with no significant difference between them.

Effect Size

Stevens (2004) describes the typical effect size of approximately 0.20 as small, 0.50 as medium and >0.80 as large. With this description of effect size, he notes that several studies confirm the majority of effect sizes found in social science research are in the small and medium category. The effect size on the significant main effects is shown in Table 17; they would all be grouped into the small category. Minimal (<0.007) was the effect size on all the interaction effects which clearly supports the non significant findings.

Table 17

Effect Size

Measure	Partial eta squared
Nursing process	16.9%
Client needs	19.3%
Critical thinking	12.10%
Pediatric topics	26.1%

Conclusion

In summary, the instrument proved to have poor reliability and validity. The analysis found no differences between the control and simulation groups on all four components of the dependent variable. This finding supported the null hypothesis that there were no differences in scores between the simulation and control groups on entry-level safe practice development. In addition the findings demonstrated significant differences on the main effect of the four components measured, Fischer LSD post hoc's identified where these differences lay. On all four ANOVA's the main effect for group was insignificant.

CHAPTER V

CONCLUSION

Chapter 5 will conclude the study by drawing interpretations and conclusions from the findings already presented. This will be followed by a discussion of the significance of the study with respect to research, practice, and theory. Limitations and assumptions underlying the study will then be discussed leading to suggested adaptations for follow-up studies. Finally, alternative points of view regarding the findings will be considered, including those of education, nursing practice, and students.

Interpretation of Findings

The purpose of the study was to investigate how simulation contributes to the development of entry-level safe practice in the nursing student. The data was analyzed using an ANOVA approach which demonstrated non significant interaction effects when all four of the dependent variable components were crossed with group. Therefore the overall null hypothesis for the study held true and was not rejected.

Null Hypothesis: There are no differences in peds ERI scores (2008) between simulation and clinical groups. $H_o: \mu_c - \mu_e = 0$.

This non significant findings suggest that a simulation mix (20/80) and a clinical experience are equally effective in developing entry level safe practice in the junior nursing student. As alluded to in the opening chapter even a non significant finding would be important to the discipline, because ‘no difference’ would suggest that clinical experiences can be replaced by simulated hours with no adverse effects on the development of safe practice.

Other reasons must be considered for the non-significant finding, some plausible explanations include:

(1) The reliability and validity of the instrument was insufficient.

(2) The clinical and simulation conditions are more similar then dissimilar.

(3) A simulation in a 20/80 mix with clinical is not large enough a mix ratio to make a notable difference in the learning experience.

(4) The power, effect size and sample size were all too small for differences to be detected in the study.

These alternative explanations for a non-significant finding will be discussed in further detail under limitations of the study.

The focus of the study was the interaction effect, however since there were no interaction effects that were significant in the analysis, the main effects of group and repeated measures were considered next. All four ANOVA’s demonstrate that the main effect for group was insignificant, meaning that regardless of which group the student was in the scores the Peds ERI (2008) scores were similar. When the pretest descriptive statistics were compared to the posttest descriptive statistics it was evident that all scores increased in a positive direction regardless of group assignment. This finding would suggest that both teaching methodologies increase the score on the Peds ERI (2008) exam.

The main effect for the repeated measures on all four ANOVA's were significant meaning that there were significant differences between the measures of the variables. These differences were further investigated with post hoc testing. Plausible explanations for the significant findings on the variables are as follows:

With the nursing process repeated measures, pairwise comparisons demonstrate significant differences between the measures of *assessment* (low) and *analysis* (high). This finding is possibly related to the level of the student, being juniors the pediatric course studied was their first experiential learning class in the nursing curriculum. In *assessment* students have to identify findings that fit the clinical condition, this is an 'application' type skill that requires practice, it is frequently difficult for the beginning student. However in *analysis* the assessment pieces are given to the student and the students are asked to identify the interrelations of the parts, this activity parallels more closely non experiential class activities and is likely to be more familiar to the student resulting in a higher score.

With the client needs repeated measures, pairwise comparisons demonstrated a split between measures of *safety* and *psychological* scoring low and health promotion and physiological scoring high. This finding is also likely related to curriculum content, the fall semester in which the study was conducted has a focus on physiological needs, in the pediatric clinical course the students are exposed to the hospitalized client whose physical needs are paramount. In addition while taking care of patients in the hospital students are practicing under the nursing social policy statement which frames all care as the prevention, promotion and restoration of health (American Nurses Association, 2003). Students will be enrolled in psychological clinical rotations and theory courses in the following spring semester, therefore it is not surprising to find this measure scoring low. A low safety score after completion of this course suggests that this one experiential course is insufficient to learn safe care provision.

With the critical thinking repeated measures, pairwise comparisons show that the measures *interpretive reasoning* and *goal setting* have the highest means. In the experiential setting cause and effect relationships can frequently be clearly identified, for example a nurse gives a medication and the blood pressure decreases, these type of relationships are reflected in a measure of interpretive reasoning. *Goal setting* ranking high is consistent with the focus of the experiential course where the students sets goals each shift for desired patient outcomes. The *application* score ranking the lowest is ironic after the students have completed an ‘application’ experience, perhaps the students are unable to transfer learning from the experiential setting to a theoretical test. Also according to Bloom’s taxonomy testing at the level of application is high this may be influencing the low score.

With the pediatric topics repeated measures, pairwise comparisons show that the measures *adolescent* and *school age* have the highest means. This finding is consistent with the exposure to patient ‘type’ the students had in the pediatric clinical course. The clinical experiences took place on units with children who were school age and older, there was minimal exposure in the clinical setting to younger children. For the simulated experience two of the four scenarios were conducted on a school aged child, and two on an infant. One of the values of simulation is its ability to create any type of “patient;” further studies should consider simulating different age groups that are not accessible in the clinical setting. The results suggest that when students have an applied experience (clinical or simulation mix) with adolescent or school aged children, their scores of entry-level safe practice in the area of these age group improve.

The focus of this study was not the main effects, however the finding that all four of the dependent variables had significant differences in their repeated measures consistently points to the need for further instruction to fully develop all measures of the dependent variable. These findings suggest that the Peds ERI (2008) instrument would be better used as a summative tool at the end of a nursing program, when all experiences and learning related to the variables are completed. In particular, the first three measures: nursing process, client needs, and critical thinking are components that are developed and refined in all clinical and theoretical courses. A better evaluation of entry-level competence would be at the end of the program. When used as a summative evaluation tool, it is more likely that there will be less significant differences between the levels of the variables as the variable will be fully developed. The dependent variable pediatric topics was the only measure that was course specific and therefore possibly suited as a formative evaluation tool. From this study in the area of topics, it appears that students need exposure to more varied age groups to gain an entry-level safe practice in pediatric topics. Pediatrics in nursing curricula is frequently dropped or limited to one course because the clinical site congestion is intensified in this area due to the vastly smaller availability of pediatric clinical sites. This is a significant finding to nursing curricula whose sole pediatric exposure is frequently limited to the one pediatric clinical course, maximizing the diversity of age groups at the site is important.

Limitations and Implications for Further Study

Several limitations of this study became evident during the process of data analysis, in particular the reliability and validity measures found on the instrument. The poor reliability and validity indicators of the instrument could be an excellent explanation for a non significant finding. A repeated study using an instrument that has good reliability and validity reports and that has quality control by the marketing company would be most beneficial.

Another limitation was the homogeneity of the sample, with 98% of the sample being white females between the ages of 20 and 25 years of age. Only one clinical course was sampled, therefore all the students were at the junior level of their studies, and the research was conducted at one site in a small mid-western university.

The power of the study was also small; power is affected by three things: group size, effect size, and the set alpha level (Stevens, 2004). All the analyses were conducted at a 0.05 level, which is typically acceptable for behavioral science research so little manipulation can be done here for further studies. The group sizes were 25 and 26, which is small, typically resulting in power levels less than 33%. Repeating the study with at least 100 per group would increase power into the 90% area (Stevens, 2004).

Effect size can be conceptualized as how much a difference the treatment makes or how far separated the group means are on the measure of the dependent variable. After analyzing the data, there appeared to be several ways to restructure the experiment to increase the effect size. These include maximizing the simulation time and reconfiguring the simulation/clinical mix. In this study, the simulation/clinical mix was 20/80; further studies could be conducted with simulation/clinical mixes of 50/50 and

80/20, the multiple groups can then be compared to determine differences as a result of the mix ratio.

Another way to increase effect size is to maximize the differences between the simulation and clinical conditions. In this study, the simulation students were given the same “type” of patients that the students in clinical had, in particular the same diagnoses and the same age group. One of the advantages of simulation cited widely in the literature is that any type of patient can be simulated (Jeffries, 2006; Nehring, Ellis, & Lashley, 2001); further studies could maximize the effect of simulation by providing several different types of patients that students may not see in the clinical setting.

Finally the effect size of simulation could be increased in a follow-up study that would run the experiment across several clinical courses. For example, as the students progress through their junior and senior years of study, the simulation group will have a simulation/clinical mix in all their clinical courses versus the clinical group will simply continue with 100% clinical through their course of study. This would increase the amount of simulation hours across multiple courses and also make better use of the tool as a summative measure, as previously discussed.

The limitations of the instrument, the sample, power and effect in this study can possibly all have contributed to the non significant interaction effect found. All of these limitations however can be adjusted as described to improve further experiments.

Significance

Though no statistically significant differences were found between the simulation and clinical groups in this study, this finding has great importance to the discipline of nursing education in the areas of research, practice, and theory as it provides support for a new experiential learning methodology that develops entry level safe practice.

Significance to Practice

This study gives support to the use of simulation as an alternative experiential learning methodology for nurse educators. As in this study at the level of a 20/80 simulation/clinical mix, there appear to be no differences in entry-level safe practice development. Even a 20% reduction in pediatric acute care clinical space needs will provide tremendous relief to overtaxed clinical sites. The Society of Pediatric Nurses (2008) are calling for creative alternatives to pediatric experiences to increase pediatric exposure in nursing curricula. A study that shows some part of pediatrics experiences can be simulated with no detrimental effect on student safe practice outcomes is important.

Significance to Research

The literature abounds with studies and national organizations that are calling for further vigorous research in the effectiveness of simulation, this study responds to that call and contributes to the much needed research data (Bearson & Wilker, 2005; National League for Nursing, 2003; Landeen & Jeffries, 2008). This study is important because it contributes to the literature base and demonstrates that simulation at a 20/80 mix has no adverse effect on entry-level safe practice outcomes. This finding is important to regulatory bodies that are currently trying to set mandates on the percentage of clinical hours that can be obtained through simulations. Currently 16 states have given nursing schools permission to use simulation hours on a case-by-case basis (Nehring, 2008); more research is needed to make decisions on the replacement of clinical hours with simulation. This current study gives support to the impetus to continue research in the efficacy of this training model. In addition, follow-up studies suggested in this chapter bring ideas for ways to improve the statistical power in simulation experiments.

Significance to Theory

An insignificant finding in any study does not support the theory that framed the intervention conducted. However in this study's case one of the plausible explanations for the no difference finding was that the clinical environment is also richly embedded in constructivist philosophy and principles, therefore even a well planned intervention structured in theory does not differ enough to the already rich learning environment of the clinical setting. When compared to each other both the clinical and simulation condition have characteristics that very naturally fit into a constructivist philosophy, there are some conditions in clinical that are better suited to constructivism (such as tasks like drawing blood, which are more authentic); there are some conditions that are better suited to the simulation environment (such as the use of a spiral curriculum that is connected back to the classroom). A reasonable conclusion that could be drawn as to why there was no differences in scores between the groups is that both conditions are richly embedded in theory, each with their own strengths but not distinct enough or disconnected from theory to show any difference.

Another plausible explanation for the non-significant finding was because this study was framed in educational theory but the instrument was developed from nursing practice. In this study there is a gap between the theoretical frame that developed the intervention (simulation from education) and the measured outcome that is a purely nursing concept (entry level safe practice). From the beginning the study was developed to capitalize on a dynamic relationship between the two disciplines of nursing and education. The study was framed by experiential learning theory from education and the nursing simulation model from nursing, it was essential that the two theoretical components interacted together to produce the desired outcome of effective educational pedagogy for entry level safe practice. The Peds ERI (2008) instrument mirrors the national liscencing exam which is developed and continually modified by national standards of nursing practice rather than theoretical reasons. Nursing is an applied science and clinical practice is central to nursing. In a pure science research is conducted with measures that are frequently developed directly from theory, in contrast in an applied science measurement comes from its practice. The practice of nursing is identified by the concepts that identify its metaparadigm, these include: humankind, environment, health, caring and nursing (Haynes, Boese and Butcher, 2004). These concepts are understood by the learner as the discussions become greater than the content itself as described earlier in experiential learning theory. An instrument that measures entry level safe practice should be intricately connected to these concepts. The gap between the theoretical frame and the measured outcome highlights the need for collaboration between nursing educators and practice professionals. In an applied science the theory and the practice must communicate to produce nurses that are current in practice issues but are also making decisions and functioning within the metaparadigm concepts of the nursing discipline.

Underlying Assumptions and Implications for Further Study

Several underlying assumptions surfaced during the course of the research; these assumptions shaped the study in varying degrees. The first assumption held was that “one methodology is better than the other,” either clinical or simulation is superior in preparing students for entry-level safe practice. This framed the study questions as “How is entry-level safe practice affected by...” The resulting data showed both methodologies contribute to improving post-test scores with neither being superior. Changing the assumption to: “both pedagogical approaches have validity” reframes the study questions to: “What type of learner does better in simulation versus clinical?” or “What type of learning need fits a simulation versus clinical experience better?”

The second assumption identified was: “All learning needs can be met in simulation.” With the recognition of limitations in measurement, instrumentation, reliability, validity, and design, it was evident that learning encompasses more than what can be simulated. The unpredictability of the clinical condition is important to the learning of how to be a safe nurse. There is a level of psychological safety for the student when the scenarios are textbook formatted; the answers can be readily extrapolated and are not as gray as the world of practice. Though simulation is very effective for the junior student, the senior student needs to learn to function in a world that is unique and complex; a simulated environment for the senior student can become a crutch rather than a building block for further learning. Though some would argue that unpredictability can be simulated, it is still under the instructor’s control; only the clinical setting provides the scenario where anything can happen without preconceived knowledge of the instructor or student. Therefore from a pedagogical perspective, it appears that simulation is best suited for the beginning junior student. As a result of this recognition, the new assumption is restructured to: “Only certain types of learning needs are best suited for simulation,” and the questions are now reframed to “What types of learning needs are best addressed in simulation?" or "What level of student is best suited to have a simulated experience?"

Study Findings and Alternative Points of View

There are several stakeholders in the results of simulation studies. The first group already addressed are the nurse educators who are exploring new ways of effectively teaching students to become safe entry-level nurses as demonstrated by successful completion of the nursing licensure exam (NCLEX) (2008). A second group of stakeholders, however, are practicing nurses who are accepting graduating nurses as new colleagues. While defining the scope of the problem for this study it was evident that the requirements for a nurse entering the profession today are evolving rapidly, coinciding with the shifting climate of the acute care environment. Today upon employment the novice nurse is immediately incorporated into an interdisciplinary health care team where collaboration skills and communication skills are paramount. In addition the novice nurse must be proficient in assessment skills and able to manage the changing technology at the bedside. As many authors alluded to in different manners, there is a need for nursing professionals who can make the "best" decision in complex, multifaceted situations (Elder & Paul, 2003; Cole, 2002; Long, 2004; Tanner, 2006). Though the NCLEX exam (2008) has long been a valid and reliable measure of entry-level safe practice, the needs of the profession are changing and therefore current measures of evaluation must be addressed. Nursing must respond to the call from its National League (2003) to: "rethink clinical education in order to design new methods that meet student needs to learn, practice, and prepare graduates to thrive in today's health care environment" (p.3). With this mandate to change, nurse educators have the responsibility to develop methods of evaluation that fit the required outcomes. The NCLEX exam (2008) for today's practice expectations is a limited measure, only on areas of safe practice that can be effectively evaluated in multiple choice formats. Some of the professional behavior attributes that are desired, such as interdisciplinary communication, may better be measured in a practice environment than in the constraints of a multiple choice test like the NCLEX exam (2008). Several studies have called for an ongoing collaboration between nurse educators and practice professionals to identify outcomes for beginning nurses today. An outcome of this collaboration should be to create new measures that can be tested and refined to evaluate safe practice on the theoretical side as well as the practice side of the profession.

The final group of stakeholders are the students. The literature showed repeatedly that students view simulation positively and enjoy this teaching approach (Mandorin, 1999; Feingold, 2004; Schoening, Sitner and Todd 2006). This satisfaction reported in the literature was also heard in unsolicited anecdotal statements by the participants in this study. These statements are summarized in the table below.

Table 18

Unsolicited Student Anecdotal Comments

I had fun!
I think simulation was wonderful. It should definitely be a requirement. I learned so much more than I do in the clinical setting

This was much more helpful than even the clinical experience was.
This was the best thing I could have done this semester. It should be used more for the lab.
This experience was incredibly helpful, even more so than actual clinical. The students were able to act as the lead nurse and develop critical thinking skills.
I would love to see our skills lab incorporate this type of experience once a week. It helped so much, and it showed the exact things I need to work on.
I really hope we can make this a standard part of the nursing program. I learned so much in this lab, maybe even more than I did in clinical.
It was an experience I think should continue as it is very challenging and interesting.
This was great; should do more.

These comments support the impetus to continue researching the efficacy of simulation as an alternative experiential learning modality.

Summary of Findings

This study failed to reject the null hypothesis and found no differences in safe practice measures on students enrolled in a simulation mix versus a clinical experience. Several plausible explanations for this finding have been given including:

1. There are no differences between simulation at 20/80 mix and clinical in the development of safe practice

2. The power, effect and sample size were too small for a difference to be found.
3. The instrument did not have the reliability and validity measures needed to detect differences between the groups.
4. The instrument should not have been used as a summative measure.

Despite the no difference finding this study is significant to the discipline of nursing education as it provides research that can support the replacement of some clinical hours with simulation. The conclusions to the study provided insight that measuring safe practice with the use of an NCLEX like exam is limited. New measures for evaluation of safe entry level nursing need to be developed as a collaborative effort between educators and practice professionals.

In conclusion, the needs of the hospitalized client today are complex and are compounded by the aging of America, the prevalence of underlying chronic illness and the increased use of life saving technology. Nursing education continues to have a responsibility to the public to graduate safe practice professionals. Nurse educators must find the balance of holding onto the traditional preparation methodologies such as rich clinical experiences that provide vicarious learning of human care, while embracing the innovative such as the simulation lab where safe nursing care can be practiced and refined.

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APPENDICES

Appendix A

NURS 3253: PEDI Clinical Preparation Form
Client name (last name only): Gender: Age:
Diagnosis (definition)
Discuss the pathophysiology (how the physiologic process is interrupted, etiology)
Please list signs and symptoms of pathophysiology; star the ones your client exhibits.
Please list the usual medical management of this pathology: (fluid therapy, diet therapy, drug therapy, surgery, physical therapy, respiratory therapy etc) Be prepared to discuss the rationale for various types of management.
Please list nursing assessment parameters directly related to client's pathophysiology.

Possible nursing diagnosis: (from textbook but correlated directly with pathophysiology and nursing assessment. Please list)

Projected teaching needs (correlated directly with pathophysiology , assessment and diagnoses)

Routine meds and frequently used PRN meds. Please identify 3 principle side effects and 2 nursing implications. State if the dose is safe for your patient.

MED/USE DOSE SAFE SIDE EFFECTS NRSG CARE

1.

2.

3.

4.

Stage : Growth and development (cite supporting behaviors)

Cultural/spiritual assessment

Nutritional assessment (cite supporting physical evidence)
Narrative assessment

Critical Thinking Clinical Journal

Throughout the semester you will turn in a critical thinking clinical journal weekly. The purpose of the journal is to facilitate critical analysis, evaluation, and problem solving skills related to incidents you encounter during your clinical experience. The journal is like a dialogue between your instructor, you, and the context of your clinical experience.

It is an opportunity to question, to explore, to analyze, to evaluate new ideas, to develop a reflective practice. Grading will be on the quality of critical thinking. Each week the journal will be submitted with the following included:

Application of Theory to Practice:

1. Discuss an experience that you had in the simulation lab that was directly related to content you discussed in one of your classes. Address whether what you experienced was congruent with what you have learned in class, or whether there was in congruency.

Bonus: If there was an in congruency: Why do you think the differences exist? When theory and practice are not congruent how does it affect the care your patient receives (in your particular situation)?

Nursing Roles:

2. Reflect on the nursing roles you observed and on your clinical performance this week. List 5 things you learned this week. List 5 objectives for your next clinical.

3. Complete a care plan for your patient as directed by your clinical instructor.

Reflective Practice:

4. What was your most beneficial learning experience in clinical this week?

5. What was the most difficult learning experience you had in clinical this week?

6. Evaluate teaching that you carried out during this clinical experience, the methods used to facilitate learning, the learning environment, etc.

Appendix B

Simulation # 1: Mild Respiratory Distress/Asthma
Estimated simulation time: 40 minutes

Brief Summary (simple case)
This case presents a pediatric patient in mild respiratory distress. The patient has a history of asthma. The student will be expected to demonstrate appropriate treatment of respiratory distress.

Learning Objectives (same as clinical-course objectives)
1. Applies pathophysiological and psychosocial concepts to the nursing care of the acutely ill client
2. Demonstrates the use of the nursing process in providing basic nursing care for the acutely ill client
3. Demonstrates proficiency in selected skills in providing basic nursing care of the acutely ill client
4. Demonstrates basic knowledge of pharmacologic and medical management of specific health alterations
5. Applies knowledge of developmental stages in the nursing care of the acutely ill client
6. Demonstrates responsibility for personal and professional learning

Scenario-Specific Objectives (simulation-specific objectives)
1. Demonstrates "five rights" of medication administration
2. Implements focused respiratory assessment
3. Recalls indication for oxygen therapy
4. Appropriately evaluates pulse oximetry
5. Recognizes signs and symptoms of respiratory distress
6. Completes a focused respiratory assessment
7. Selects appropriate oxygen delivery devices
8. Draws arterial blood sample and prepares appropriate packaging to send to laboratory
9. Administers nebulized medication
10. Teaches client how to use an inhaler
11. Teaches client how to use a flow monitor
12. Evaluates patient assessment and vital signs
13. Demonstrates effective team work

Report to Students (via tape recorder from off going shift)
Janice is African American. She is eight years old and lives with her mother who has recently moved in with a new boyfriend that Janice does not like. Janice has had asthma for five years. She has had multiple ER visits for acute aerations and states she follows her treatment plan some of the time. She presents to the ER as alert and responsive; she appears anxious and is sweating. Her mother is with her and appears much stressed by the situation.

Additional Information

Patient Data: Weight 110 pounds; Height 60 inches
Medical Record: #PCS 131000
Medical History: Cromolyn I puff Q D
Albuterol inhaler PRN respiratory distress

Approximate Simulation Progression

Monitor Settings	Manikin Actions	Student Interventions	Cues
Initial State: HR 100 RR 24 Temp 98.8	Bilateral wheezing Pt sates "I can't get enough air." Coughing – green sputum	Wash hands Introduce self Head of bed up Check patient ID Check physician orders Attach Sat monitor Sat 98% Obtain vital signs Listen to lungs	Pt states: "I cannot breathe lying down."
Nasal canula 2-4L Sats 91%	"I feel like my heart is pounding and I can't breathe."	Attach ECG monitor Apply nasal canula per orders – titrate for Sats Ask 2^{nd} nurse to bring in nebulizing treatments Speak to pt in calm, reassuring manner Keep mother updated	Mother states: "I think she needs oxygen and a treatment."
RR 18 HR 92 Sats 95%	Breath sounds clear Pt states "I am feeling much better."	Administer nebulized treatments Reassess lungs Reassess vital signs Evaluate effect of medication Review physicians orders	Patient states: "I don't think I am wheezing any more."
RR 18 HR 92 Sats 85%	Pt states: "I don't really know how to use my inhaler."	Collect sputum sample and send to lab Teach patient use of inhaler with spacer Teach patient how	Mother states: "Can you show us how to manage her asthma better at home?"

		to assess lung volumes – involve mother in instruction	

Debriefing/Guided Reflection Overview

Asthma is increasing in the United States, possibly related to pollution, poor access to medical care, under diagnoses, and under treatment. It accounts for 2 million ER visits every year; it is the most common chronic disease in childhood.

Risk Factors:	Ages 3 to 8 Gender males > females Smoking (including second hand) History of previous attacks Psychosocial problems/stress Increased in African Americans
Preventative Care:	Identify and avoid triggers Manage medications Control weight Regular exercise

Simulation # 2: Severe Respiratory Distress/Status Asthmaticus
Estimated simulation time: 40 minutes

Brief Summary (complex case)
This is a client in acute respiratory distress. The student will be able to quickly triage this patient as emergent and be expected to prepare room and staff for impending respiratory arrest. The student will prioritize physician orders and provide immediate bronchodilator therapy.

Learning Objectives (same as clinical-course objectives)
1. Applies pathophysiological and psychosocial concepts to the nursing care of the acutely ill client
2. Demonstrates the use of the nursing process in providing basic nursing care for the acutely ill client
3. Demonstrates proficiency in selected skills in providing basic nursing care of the acutely ill client
4. Demonstrates basic knowledge of pharmacologic and medical management of specific health alterations
5. Applies knowledge of developmental stages in the nursing care of the acutely ill client
6. Demonstrates responsibility for personal and professional learning

Scenario Specific Objectives (simulation-specific objectives)
1. Implements quick respiratory assessment
2. Appropriately evaluates pulse oximetry
3. Recognizes signs and symptoms of respiratory distress
4. Works closely with physician and follows verbal orders appropriately
5. Analyzes arterial blood gas
6. Implements relevant cardiac and respiratory monitoring
7. Communicates and works within interdisciplinary team
8. Initiates IV
9. Delivers IV medication
10. Interprets bronchodilator blood levels
11. Has intubation equipment at the bedside

Report to Students (via tape recorder from EMS staff)
Janice is brought to the Emergency Room by ambulance after collapsing on the soccer field. She has a history of asthma with multiple hospital admissions. She is unable to speak other than simple one-word statements. She has an IV of normal saline running at a keep open rate. She has a 100% non-rebreather mask in place with sats of 92%.

Additional Information

Patient Data:	Weight 110 pounds; Height 60 inches
Medical Record:	# PCS 131000
Medical History:	Cromolyn I puff Q D
	Albuterol inhaler PRN respiratory distress

Approximate Simulation Progression

Monitor Settings	Manikin Actions	Student Interventions	Cues
Initial State: HR 130 RR 42 Temp 98.8 Sat 92% on 100% non rebreather	Inspiratory wheezing Pt states: " please …help…"	Wash hands Introduce self Head of bed up Check patient ID Check physician orders Attach Sat monitor Attach cardiac monitor Sat 98% Obtain vital signs Listen to lungs Calm patient Have 2nd nurse call physician	Mother states: "We need a doctor now."
RR 46 HR 130 Sats 88%	No air movement noted, minimal chest movement	Communicate with physician clearly – draw aerosolized med in room and deliver to patient Instruct 2nd nurse to get respiratory personnel and prepare IV medication Reassure Mother; ask her to sit in convenient place Monitor vital signs continuously	If student is unsure of what to do, physician will guide with clear instructions
RR 30 HR 115 Sats 96%	Breath sounds loud wheezes throughout both lung fields	Follow physicians orders Start IV Draw up theophylline IVPB, calculate bolus and drip rates Draw ABG and theophylline level after bolus	Physician states: "Be sure not to draw the lab until after the bolus is in."
RR 25	Pt states: "I feel	Ask physicians if	Physician states:

HR 92 Sats 100%	better now."	oxygen can be weaned to alternative delivery device Report ABG and discusses values with MD	"What did the blood gas look like?"

Debriefing/Guided Reflection Overview
Status asthmatics occurs when children continue to display respiratory distress despite vigorous therapeutic measures. It must be recognized as a medical emergency that can result in respiratory failure and/or death. Persistent hypoventilation leads to Co2 accumulation and acidosis.

Treatment: B2 agonists and corticosteroids
Patient needs reassurance
Intubation equipment should be at bedside

Simulation # 3: Pediatric heart disease/heart catheterization
Estimated simulation time: 40 minutes

Brief Summary (simple case)
Student will need to demonstrate safe post operative care of a cardiac cath client. Will need to demonstrate how to check for bleeding and interrupted perfusion. Student will also demonstrate cardiac assessment skills.

Learning Objectives (same as clinical-course objectives)
1. Applies pathophysiological and psychosocial concepts to the nursing care of the acutely ill client
2. Demonstrates the use of the nursing process in providing basic nursing care for the acutely ill client
3. Demonstrates proficiency in selected skills in providing basic nursing care of the acutely ill client
4. Demonstrates basic knowledge of pharmacologic and medical management of specific health alterations
5. Applies knowledge of developmental stages in the nursing care of the acutely ill client
6. Demonstrates responsibility for personal and professional learning

Scenario Specific Objectives (simulation-specific objectives)
1. Implements post catheterization assessment
2. Recalls signs and symptoms of bleeding
3. Provides comfort measures to client
4. Appropriately evaluates post catheterization lab work
5. Recognizes signs and symptoms of good perfusion
6. Teaches client how to eat a healthy heart diet
7. Evaluates patient assessment and vital signs
8. Demonstrates effective team work
9. Describes normal cardiac anatomy and ASD anatomy

Report to students (via tape recorder from off going shift)
This is a case of a 5-year-old newly diagnosed with an Atrial Septal Defect. She is admitted to your unit following a pediatric heart catheterization. She is slightly nauseated and does not like lying flat. Her parents are at the bedside and appear very tense.

Additional Information

Patient Data:	Weight 80 pounds; Height 60 inches
Medical Record:	# PCS 1624000
Medical History:	None NKA

Approximate simulation progression

Monitor Settings	Manikin Actions	Student Interventions	Cues
Initial State: HR 85 RR 17 Temp 98.8	Heart sounds S1 and S2 with no murmur Pressure dressing in place – dry +2 pulses in foot Pt states "I feel like throwing up"	Wash hands Introduce self Check Patient ID Check physician orders for antiemetic Attach cardiac monitor Keep HOB flat – position pt on side Obtain vital signs Listen to chest Evaluate leg and distal perfusion	Mother states: "Can we roll her over in case she vomits?"
HR 120 RR 32	Patient crying and then vomits	Administers Zofran – appropriately Cleans pt up Checks IV infusion and rate Assess effect of medication	Mother states: "Will the medicine make her sleepy?"
RR 18 HR 80	+1 pulse in foot Pressure dressing with oozing noted Hematoma at catheterization site Patient sleeping	Reassess leg Looks under dressing and notes size of hematoma Palpates pulse and notifies physician of findings	Mother states: "Is everything okay?" 2nd Prompt "increase rigor of bleeding"
RR 18 HR 92	Pt states: "I do not feel nauseated any more."	Rechecks insertion site and perfusion – documents appropriately Discusses post catheterization lab with 2nd nurse – does not call physician since all is within normal	2nd nurse states: "Have you seen the lab yet?"
	Pt states: "Can you tell me what an ASD is?"	Provides discharge teaching to mother. Provides	Mother states: "Are there any restrictions we need to know

		explanation of what an ASD is, includes drawing.	about when we go home?”

Debriefing/Guided Reflection Overview

Cardiac cath is an invasive diagnostic procedure, often performed prior to cardiac surgery. It is a good opportunity to familiarize family with the hospital setting and what to expect for upcoming surgery. Provides information on oxygen saturation of blood in chambers and flow of blood through heart; pressure changes within the cardiac structures; and anatomical abnormalities.

Possible complications include:
Acute hemorrhage
Nausea/vomiting
Loss of pulse in extremity
Transient dysrhythmias

Simulation # 4: Congestive heart failure/Ventricular Septal Defect
Estimated simulation time: 40 minutes

Brief Summary (complex case)
This is a client in congestive heart failure. The student will demonstrate how to safely initiate Digoxin therapy. The student will also demonstrate ability to interpret electrolytes lab and how these are affected by the treatment protocols. Students will also work with the family on helping the infant gain weight so that he can be ready for his upcoming surgery.

Learning Objectives (same as clinical-course objectives)
1. Applies pathophysiological and psychosocial concepts to the nursing care of the acutely ill client
2. Demonstrates the use of the nursing process in providing basic nursing care for the acutely ill client
3. Demonstrates proficiency in selected skills in providing basic nursing care of the acutely ill client
4. Demonstrates basic knowledge of pharmacologic and medical management of specific health alterations
5. Applies knowledge of developmental stages in the nursing care of the acutely ill client
6. Demonstrates responsibility for personal and professional learning

Scenario Specific Objectives (simulation-specific objectives)
1. Implements focused cardiac assessment
2. Appropriately evaluates pulse oximetry for cardiac defect
3. Recognizes signs and symptoms of right- and left-sided heart failure
4. Administers Digoxin and Lasix appropriately – able to identify effects, side effects, and actions of these drugs
5. Analyses basic metabolic panel
6. Places a Foley catheter
7. Mixes high calorie formula
8. Teaches parents how to maintain high calorie feedings

Report to students (via tape recorder from EMS staff)
3-month-old Mikey came in this morning for CHF. He is breathing hard using accessory muscles. His chest x-ray shows significant cardiomyopathy. He is being started today on IV digoxin and lasix. HE is being cared for by his elderly grandparents who are at the bedside. They report that he is eating about 2 to 3ounces of Enfamil formula every 4 hours.

Additional Information
Patient Data: Weight 10 pounds; Length 23inches

Medical Record: # PCS 177586300

Medical History:

Approximate simulation progression

Monitor Settings	Manikin Actions	Student Interventions	Cues
Initial State: HR 160 RR 62 Temp 98.8 Sat 95%	Crackles in both lungs Large VSD murmur Chest x-ray with cardiomyopathy Pt refusing to eat	Wash hands Introduce self Head of bed up Check Patient ID Check physician orders Attach Sat monitor Attach cardiac monitor Obtain vital signs Listen to lungs/heart Document findings	2nd nurse states: "He looks like he is in distress; what do his lungs sound like?"
RR 66 HR 160 Sats 98%	Same as above	Calls physician for orders Starts IV and administers Digoxin per orders Checks dose of Digoxin with 2nd nurse	Grandmother: "Can we call the doctor now so that we can give him some medicine?"
RR 52 HR 130	Breath sounds clear Large VSD murmur Baby taking bottle with large nipple	Evaluates effect of Digoxin therapy Administers Lasix as ordered Switches nipple to preemie nipple	2nd nurse: "Maybe a preemie nipple will help his suck."
RR 40 HR 120	Pt more vigorous kicking and cooing	Discusses feedings with grandmother Demonstrates how to mix feedings to higher calorie formula Calls lab work to physician	Physicians orders to initiate high calorie feedings Physician calls to check on lab data

Debriefing/Guided Reflection Overview

1% of children are born with congenital heart disease. 1% of these will be symptomatic in the first year of life. 35 of the cardiac defects are well recognized. Often with cardiac defects there are other abnormalities and the patients should be screened for these. CHF is the inability of the heart to pump an adequate amount of blood. Heart failure is manifested by pulmonary and systemic congestion. Management of CHF in infants includes inotropes and diuretics.

Appendix C

CONSENT TO PARTICIPATE IN A RESEARCH STUDY
OKLAHOMA STATE UNIVERSITY

PROJECT TITLE: Comparison of a pediatric simulation experience to a pediatric clinical practicum

INVESTIGATORS: Jasmin Johnson, MS

PURPOSE:
This study, which is research conducted for a doctoral dissertation, is being conducted through Oklahoma State University. The purpose is to examine whether simulated lab experiences in the School of Nursing can be substituted for clinical hours in a hospital. You are being asked to participate for your NURS 3233 course. You will be in one of two groups, the first group will have a traditional clinical experience and the second group will have a partial clinical experience and also a simulation experience. The information used to evaluate the experiences will be your pediatric ERI score.

PROCEDURES:
The project will involve both groups completing two pediatric ERI exams, one in September and the second exam in December. The first group will complete the traditional 3 credit hour clinical course, the second group will complete 80% of the required clinical hours in a traditional manner, and the other 20% of the hours (16 hours) will be completed in the simulation lab. Both groups will have the same required number of hours to complete, also homework assignments in both groups will be the same.

RISKS OF PARTICIPATION:
There are no risks associated with this project, including grades, stress, psychological, social, physical, or legal risks which are greater, considering probability and magnitude, than those ordinarily encountered in daily life. If, however, you begin to experience discomfort or stress in this project, you may end your participation at any time.

BENEFITS OF PARTICIPATION:
You may gain an appreciation and understanding of how research is conducted. You will be providing the School of Nursing at OBU valuable information on approaches to teaching nursing

CONFIDENTIALITY:
All information about you will be kept confidential and will not be released. Research records will be stored securely and only researchers and individuals responsible for research oversight will have access to the records. This information will be saved as long as it is scientifically useful; typically, such information is kept for five years after publication of the results. Results from this study may be presented at professional meetings or in publications. You will not be identified individually; we will be looking at the group as a whole. It is possible that the consent process and data collection will be observed by research oversight staff responsible for safeguarding the rights and well being of people who participate in research.

Confidentiality will be maintained except under specified conditions required by law. For example, current Oklahoma law requires that any ongoing child abuse (including sexual abuse, physical abuse, and neglect) of a minor must be reported to state officials. In addition, if an individual reports that he/she intends to harm him/her or others, legal and professional standards require that the individual must be kept from harm, even if confidentiality must be broken. Finally, confidentiality could be broken if materials from this study were subpoenaed by a court of law.

COMPENSATION:
You will receive a grade for two clinical shifts for your participation. Other alternatives for receiving this grade is to complete 16 hours of clinical -please check with your instructor for details.

CONTACTS:
You may contact any of the researchers at the following addresses and phone numbers, should you desire to discuss your participation in the study and/or request information about the results of the study: Jasmin Johnson, MS Thurmond Hall 121, Dept. of Nursing Oklahoma Baptist University. 405-834-9239.
If you have questions about your rights as a research volunteer, you may contact Dr. Shelia Kennison, IRB Chair, 219 Cordell North, Stillwater, OK 74078, 405-744-1676 or irb@okstate.edu

PARTICIPANT RIGHTS:
Your participation in this research is voluntary. There is no penalty for refusal to participate, and that you are free to withdraw your consent and participation in this project at any time, without penalty

CONSENT DOCUMENTATION:
I have been fully informed about the procedures listed here. I am aware of what I will be asked to do and the benefits of my participation. I also understand the following statements:

I affirm that I am 18 years of age or older.

I have read and fully understand this consent form. I sign it freely and voluntarily. A copy of this form will be given to me. I hereby give permission for my participation in the study.

____ ___________________________

Signature of Participant Date

I certify that I have personally explained this document before requesting that the participant sign it.

____ ___________________________

Signature of Researcher Date

Appendix D

SCRIPT to be provided prior to informed consent

Welcome back juniors, this is an exciting semester to be a part of because you finally are ready to practice nursing in the clinical settings. This semester, in particular is additionally exciting because you will be part of a research study utilizing the human patient simulators that you all have seen come in over the past year.

You have not taken research yet but I think being a part of this study will be a great vicarious experience to see how research is conducted first hand. The study I am doing compares a pediatric clinical practicum experience to a pediatric simulated experience in the laboratory. The class will be divided into two groups – an experimental group and a control group. Those in the control group will go to clinical as always scheduled, those of you in the experimental group your hours will be split, so that 80% of the time you are in the clinical setting and 20% of your time you are in the simulated lab. At the end of the semester your scores on the peds ERI exam will be compared, we are going to be looking for differences on scores between the experimental and control group to see if a simulated experience makes a difference in score. I will code each of your scores with a randomly assigned number, so even I will not know what score you made. If you look at the overhead (attached) you will see the process summarized.

I will be asking all of you to complete an informed consent. Please read this carefully so that you know what you are signing. You can at anytime not participate in the study; this means your scores will not be considered when I compare the two groups. I want you to be sure to understand that both the scores on the post test and your performance in the simulation lab will not have any effect on your grades for the semester; your grades will be determined by your assigned clinical instructor in the usual manner.

Do you have any questions at this time? You may email me or call me also with any concerns

Thank you and I am looking forward to a great semester!

Appendix E

Assumptions of the mixed model, repeated measures ANOVA

1. Independence – one subject has no effect on the other subjects score. This assumption held true, the tests were taken in a controlled testing environment, and each subject took the test independently.
2. Identical distribution – there is no way to distinguish on subject's score form another. This assumption held true with an n>12 and randomization in the sampling procedure.
3. Homogeneity of variance the distribution of variance was the same for all groups. This was confirmed with the use of the Levene's test (Keppel and Wickens, 2004):

   Nursing process – fail to reject on all five levels

   Client needs – fail to reject on all four levels

   Critical thinking – fail to reject on all six levels

   Pediatric topics – fail to reject on all seven levels

4. Homogeneity of covariance counterpart of homogeneity of variance used in a mixed design

   Box M test was used (Keppel and Wickens, 2004):

   Nursing process – sig 0.066 fail to reject

   Client needs – sig 0.251 fail to reject

Critical thinking – sig 0.980 fail to reject

Pediatric topics – 0.279 fail to reject

5. Sphericity – covariance matrixes are spherical and are the same across groups

Hunyh-Feldt test (Keppel and Wickens, 2004) :

Nursing process – epsilon 0.889

Client needs – epsilon 0.914

Critical thinking – epsilon 0.992

Pediatric topics – epsilon 0.645

Jasmin A. Johnson

Candidate for the Degree of

Doctor of Philosophy

Dissertation: COMPARISON OF A PEDIATRIC SIMULATION EXPERIENCE TO A PEDIATRIC CLINICAL PRACTICUM

Major Field: Educational Psychology

Biographical:

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ADVISER'S APPROVAL: Steve Harrist, PhD

Name: Jasmin A. Johnson Date of Degree: May, 2009

Institution: Oklahoma State University Location: Stillwater, Oklahoma

Title of Study: COMPARISON OF A PEDIATRIC SIMULATION EXPERIENCE TO A PEDIATRIC CLINICAL PRACTICUM

Pages in Study: 124 Candidate for the Degree of Doctor of Philosophy

Major Field: Educational Psychology

Scope and Method of Study: Simulation offers an important alternative for clinical education, it provides a safe practice environment and allows for high instructor control of the environment. The purpose of the study was to investigate how simulation contributes to the development of entry-level safe practice in junior level baccalaureate nursing students. Entry-level clinical safe practice was measured using the Educational Resource Incorporated Nursing Care of Children exam. The study used an experimental approach with 26 students in a clinical experience and 25 students in a clinical/simulation mix experience. A mixed model ANOVA was used to compare the group means of the post test.

Findings and Conclusions:
There were no significant differences found on any measures of entry-level safe practice between students who received a 100% clinical rotation and students who received a 20/80 simulation/clinical mix. This finding is significant to nursing education, primarily because it demonstrates that clinical in the pediatric setting can be simulated at least in a 20/80 mix.

ADVISER'S APPROVAL: Steve Harrist, PhD