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Effect of Implementation of Simulation on Critical Thinking Skills in Undergraduate Baccalaureate Nursing Students

Joanne M. Knoesel

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Effect of Implementation of Simulation on Critical Thinking Skills in Undergraduate Baccalaureate Nursing Students

By

Joanne Knoesel

A dissertation submitted to the Graduate Faculty in Nursing in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York

2017
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Joanne M. Knoesel

This manuscript has been read and accepted for the Graduate Faculty in Nursing in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

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THE CITY UNIVERSITY OF NEW YORK
Abstract

Effect of Implementation of Simulation on Critical Thinking Skills in Undergraduate Baccalaureate Nursing Students

By

Joanne M. Knoesel

Advisor: Eleanor T. Campbell

Human patient simulation (HPS) is a time and cost intensive teaching modality that is used widely in nursing education, and has been implemented with little evidence to support its efficacy (Jeffries & Rizzolo, 2006). Researchers note the lack of reliable tools to measure learning using this teaching modality, and consequentially there is a paucity of research linking critical thinking and simulation (Jeffries, 2007; Kneebone, 2003; Nehring, 2008). Nursing clinical decision making affects patient outcomes. Critical thinking is a key factor in clinical decision making. A review of the relevant literature is equivocal on the use of simulation in undergraduate nursing programs to increase critical thinking skills. The need for further research to develop evidence that simulation can enhance critical thinking is integral to continue and expand the use of simulation as a teaching-learning strategy in undergraduate nursing programs (Hayden, Smiley, Alexander, Kardong-Edgren, & Jeffries, 2014). The purpose of this quasi-experimental study was to evaluate the effect of simulation implementation on nursing students’ critical thinking skills, as measured by Health Education Systems Incorporated (HESI) exit exam critical thinking sub-scores from cohorts of baccalaureate nursing graduates, in an undergraduate nursing education program. Benner’s (1984), model From Novice to Expert, provides a theoretical framework for identifying knowledge acquisition and level of clinical expertise based on skill competency, knowledge, and experience, and underpins this study. The findings from this study may: (a) provide insight into the relationship between simulation and critical thinking;
and (b) may strengthen current nursing programs to provide meaningful learning experiences in the education of nursing students that can impact learning outcomes and can affect patient safety in the future. Nursing education programs are challenged to ensure that nursing graduates have the knowledge and higher order critical thinking skills to make accurate clinical decisions, and to provide safe, high quality, cost effective care (National Council of State Boards of Nursing [NCSBN], 2013; National League of Nursing [NLN], 2003).
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Chapter I

Introduction

This quasi-experimental study will be presented in five chapters. This chapter presents background information on the effect of simulation implementation and its relationship to the development of critical thinking skills in a baccalaureate nursing program. Chapter one is organized into seven sections: (a) statement of the problem, (b) significance of the problem, (c) purpose of the study, (d) background of the study, (e) hypothesis, (f) research questions, and (g) summary.

The need for research to provide evidence that simulation can enhance student learning is integral to continue and expand the use of simulation as a teaching-learning strategy in undergraduate nursing programs (Hayden, Smiley, Alexander, Kardong-Edgren, & Jeffries, 2014). Some researchers note a lack of adequate tools to measure the phenomenon of “learning” in undergraduate nursing programs using simulation, as a barrier to this research (Jeffries, 2007; Kneebone, 2003; Nehring, 2008). Previous studies on simulation have focused on student perceptions, self-efficacy, and satisfaction with this teaching strategy (Bambini, Washburn, & Perkins, 2010; Blum, Borglund, & Parcells, 2009; Jeffries & Rizzolo, 2006; Liaw, Sherpbier, Rethons, & Klainen-Yobas, 2012), but limited research has been done evaluating knowledge gains. Human patient simulation (HPS) is a time and cost intensive teaching modality that is widely used in nursing education, and has been accepted with little evidence to support its efficacy (Jeffries & Rizzolo, 2006; Hayden, Smiley, Alexander, Kardong-Edgren, & Jeffries, 2014).
The importance of the use of simulation in nursing education was reinforced by the Institute of Medicine report To Err is Human: *Building a Safer Health System* (Kohn, Corrigan, & Donaldson, 2000), when it called on health care organizations and teaching institutions to develop and use simulation to train novice practitioners in an effort to reduce medical errors. Additional support for the use of simulation was reinforced with a seminal study conducted by the National League for Nursing (NLN). The NLN developed a four-phase, national, multisite, multimethod project to design and implement models for simulation use in nursing education (Jeffries & Rizollo, 2006). A recent study (Hayden et al., 2014), conducted by the National Council of State Boards of Nursing (NCSBN) used a large scale, randomized control design, to evaluate if some traditional clinical experience hours can be replaced with simulation. Findings from this longitudinal study revealed that there was no difference in clinical competency, nursing knowledge, and National Council Licensure Examination (NCLEX) pass rates between the groups. Additionally, this study found that students in the group that substituted twenty-five percent of clinical time with simulation, significantly increased their critical thinking skills. The researchers used the Critical Thinking Diagnostic instrument to evaluate students’ critical thinking. There are five categories that make up the Critical Thinking Diagnostic instrument, they are; problem recognition, clinical decision making, prioritization, clinical implementation, and reflection. There are few instruments with proven validity and reliability that measure critical thinking, and even fewer valid instruments that measure critical thinking in nursing students.

Research on critical thinking became popular in the 1980s and culminated in the landmark American Philosophical Association (APA) Delphi Report (Facione, 1990), that provided findings and expert consensus on the definition of critical thinking. This report
includes core skills of critical thinkers, and provides recommendations for critical thinking instruction and assessment. The APA Delphi report’s definition of critical thinking will be used for this study: “Critical thinking is the process of purposeful, self-regulatory judgment. This process gives reasoned consideration to evidence, contexts, conceptualizations, methods, and criteria” (Facione, 1990). The six core critical thinking skills, according to the experts are; interpretation, analysis, evaluation, inference, explanation, and self-regulation (Facione, 1990). The previously mentioned definition and skills of critical thinking are consistent with the Health Education Systems Incorporated (HESI) exit exam test model. The HESI exit exam is grounded in classical test theory and critical thinking theory and is designed to define the constructs indicative of behaviors required for entry-level practice (Morrison, Adamson, Nibert, & Hsia 2004). Developed by Morrison, Nibert, and Flick (2006), each test item is written at the application and analysis level to evaluate critical thinking abilities in nursing students. These test items measure the student’s ability to use clinical judgement, and apply knowledge to clinical practice situations. Innovative teaching and assessment strategies must be used to support the development of critical thinking in nursing students, the results of which will impact patient outcomes.

Outcomes evaluated in research focusing on the use of simulation in nursing education can be categorized into three themes: critical thinking, application to practice, and confidence and perceived competence. Together the data to date reveal that simulation may provide more focused and deeper learning experiences to engage undergraduate nursing students compared to traditional methods such as lecture (Burns, O’Donnell, & Artman, 2010; Howard, Ross, Mitchell, & Nelson, 2010; Swanson, Nicholson, Boese, Cram, Stineman, & Tew, 2011). The outcomes of simulation such as increased critical thinking skills, easing transition to practice,
and the relationship of confidence and competence, however are still to be determined (Blum, Borglund, & Parcells, 2010; Liaw, Sherpbier, Rethans, & Klainin-Yobas, 2012). The literature suggests that there is value in teaching skills in simulated environments, but some experts question the value in terms of student patient care experience, i.e. knowledge versus application of information (Parr & Sweeney, 2006; Moule, Wilford, Sales & Lockyer, 2008; Shiavenato, 2009). Of note, is the expansion of nursing programs using simulation during the past two decades. A survey conducted by Hayden (2010), to ascertain the number of nursing programs using simulation, elicited responses from 1,060 U.S. schools of nursing. Eight-seven percent of these nursing programs reported the use of some type of simulation currently in more than five of their nursing courses. A recent report by the NLN has updated that number to ninety-six percent of nursing programs using simulation currently (Jeffries, Dreifuerst, Kardong-Edgren, & Hayden, 2015).

Approaches to using simulations may vary in design and fidelity (realism), but most include pre-simulation briefing, simulated clinical scenarios, and post-simulation debriefing. Facilitators of simulation report that true learning occurs through reflection and self-identification of errors by students during debriefing processes (Rockstraw & Wilson, 2012). There are many types of simulations, including the use of task trainers (low fidelity), human patient simulators (high fidelity), and standardized patients (actors), or a combination of types. According to Bambini et al., (2009), the use of high fidelity simulators as a teaching-learning strategy can enhance the transfer of confidence and competence from the classroom to the clinical setting. Simulation scenarios in nursing education can provide experiences that enable learners to practice their nursing knowledge and skills, resulting in enhancement of their critical thinking skills. According to Dewey (1933), knowledge gained through critical thinking occurs
with clinical experience practice, in which the learner must be actively involved. Additionally, repeated experiences of practice contribute to knowledge, improve critical thinking and decision making, and are integral for the development of clinical judgment in future situations (Benner, 2005; Tanner, 2006).

Statement of the Problem

Effective education requires nursing students to apply classroom knowledge to clinical practice. Simulation of clinical situations is an active-learner centered teaching strategy that can provide opportunities for nursing students to apply and synthesize classroom knowledge in realistic and non-threatening environments (Jeffries & Rizzolo, 2006). The complexity of our current health care system demands nurses with higher-order critical thinking skills to provide safe, effective, quality care. Critical thinking involves the application of knowledge and experience to identify patient problems and to direct clinical judgments and actions that result in positive patient outcomes (Benner, Hughes, & Sutphen, 2008). Research on the relationship between simulation learning and the development of critical thinking skills in nursing students is integral, in order to improve patient outcomes. The lack of valid and reliable instruments to evaluate critical thinking skills in nursing students is problematic, as measurement of application of knowledge is integral to ensure that nursing programs are preparing students for practice.

Significance of the Problem

Use of simulation as a teaching strategy for nursing students may help to improve critical thinking and as a result reduce human errors and improve patient safety. Simulation scenarios provide experiences for nursing students to improve communication and teamwork, and develop skills such as delegation, prioritization, and critical thinking (Rockstraw & Wilson, 2012). There is some evidence to suggest that use of simulation is also helpful in substituting for lack of
clinical situations (Bambini, Washburn, & Perkins, 2009). Simulation learning environments promote risk taking and allow for mistakes; they help to improve or validate student-centered learning, and provide opportunities for formative or summative evaluation in safe learning environments (Reising, Carr, Shea, & King, 2009). Simulations can expose students to high risk, low incidence scenarios and may help to decrease anxiety in clinical settings (Rockstraw & Wilson, 2012).

Studies have shown that during simulation students are actively engaged, obtain immediate feedback, gain reinforcement of learning, and make connections between lecture content and clinical practice (Jeffries, 2007). Additionally, using simulation in nursing education can facilitate learning and skill transfer when students care for patients in the health care environment (Jeffries & Rizzolo, 2006). Simulations can provide the environment for learners to enhance their critical thinking skills through repeated practice, reflection, and retention of experiences, which may impact the care and safety of their patients in the future (Jeffries, 2007).

Critical thinking skills are essential for nurses to respond efficiently and effectively to the situations they encounter while caring for patients. Critical thinking skills include questioning, analysis, synthesis, interpretation, inference, inductive and deductive reasoning, intuition, application and creativity. (American Association of Colleges of Nursing [AACN], 2008b).

By designing simulation scenarios to the level of learners, nursing education can progress from simple task-oriented skills to providing complex simulation experiences that can affect a students’ clinical decision making abilities (Yuan, Williams, & Fang, 2011). Clinical decision skills can be translated to clinical practice through improved communication with members of the healthcare team, which may improve patient outcomes (Zavertnik, Huff, & Munro, 2010). Simulation as a teaching strategy enables student nurses to think critically and give students the
opportunity to practice in a safe environment, providing experiences that would be impossible to capture in actual practice situations with patients (Benner, Hughes, & Sutphen, 2008). The use of simulation can be an effective solution to the previously mentioned problems, but the effectiveness of this modality must be evaluated. Unfortunately, the lack of valid and reliable instruments to measure critical thinking with simulation learning provides a gap in current research. Therefore, a quasi-experimental study was conducted comparing Health Education Systems Incorporated (HESI) exit exam critical thinking sub-scores, before and after implementation of high fidelity simulation experiences in an undergraduate nursing program.

Content validity for the HESI exit exam is achieved through use of the NCLEX-RN exam blueprint to determine content, types of questions, and reading level. Nine studies that investigated the validity of the HESI exit exam indicate that it is 96.36%-99.16% accurate in predicting NCLEX-RN success (Lauer & Yoho, 2013). HESI exit exams range in the highest categories for estimated reliability coefficients using the Kuder Richardson Formula 20 (KR-20) and range from 0.90 to 0.94. Reliability is determined for each edition and version by conducting item analyses on each exam and statistically calculating reliability (Elsevier, 2016).

**Purpose of Study**

The purpose of this study was to evaluate the effect of simulation implementation on nursing students’ critical thinking skills as measured by Health Education Systems Incorporated (HESI) exit exam critical thinking sub-scores from cohorts of graduated students. HESI critical thinking sub-scores, measure the student’s ability to use critical thinking skills necessary for clinical decision making and judgment (Morrison, Nibert, & Flick, 2006). The student scores were compared between two academic years; prior to the implementation of simulation, and after the implementation of simulation, in a private university’s baccalaureate nursing program.
Benner’s (1984), model *From Novice to Expert* provided a framework for this study. This study will evaluate the impact of simulation implementation (in a baccalaureate nursing program), throughout the curriculum on undergraduate nursing students’ critical thinking skills.

**Background of Study**

Before simulation was formally introduced in the nursing program at a private university in the northeast, simulation was sporadically used in the traditional and accelerated undergraduate nursing programs across two campuses based on faculty preference. Following significant and costly renovations of new simulation centers on both campuses, two faculty members proposed a pilot program to fully implement simulation into both undergraduate nursing programs. The pilot program incorporated human patient simulators (HPS), standardized patients (SP’s), and hybrid simulations (using a manikin and a standardized patient). After evaluation of the initial pilot program, and based on faculty consensus, simulation was fully integrated into the curriculum during the fall semester of 2012.

Currently nursing students are required to participate in simulations for every course in the curriculum (Foundations, Communications, Mental Health Nursing, Pathophysiology I, Adult Medical-Surgical Nursing, Maternal-Newborn Nursing, Pharmacology, Child Health Nursing, Community Nursing, Leadership in Nursing, Critical Care Nursing, and Ethics), except Nursing Research and Pathophysiology II, which are linked to the didactic course objectives. With the exception of the medical-surgical nursing course, all required simulations are in addition to classroom and clinical hours, and consist of a two to three hour simulation session. The full day medical-surgical simulation lab substitutes one clinical day, with students participating in a scenario with a manikin and standardized patient, and includes a videotaped medication administration simulation. This university uses simulation scenarios from the
National League of Nursing (NLN) and Laerdal. Based on the NCLEX test plans, these simulations have been developed and evaluated to demonstrate the relationship between the process and its intended purpose. They are specific, sensitive, reliable, and reproducible (Jeffries, 2007). Additionally, Standards for Best Practice from the International Nursing Association for Clinical Simulation and Learning (INACSL), were incorporated in the development and execution of each simulation scenario, starting with the pre-simulation assignment, and ending with debriefing. Consistent nurse faculty, skilled in simulation practices, facilitate all simulations on both campuses. Additionally, nursing faculty teaching didactic theory courses have been consistent during the proposed study’s timeframe. A need for further assessment of the relationship between the development of students’ critical thinking skills with simulation implementation became evident with the expansion of simulation use in the nursing program at this university, as well as the increase in simulation throughout the United States.

**Hypothesis**

1. There will be a statistically significant difference in HESI exit exam critical thinking sub-scores (which measure the student’s ability to use critical thinking skills necessary for clinical decision making and judgment) for students who participate in an undergraduate nursing program with simulation implementation when compared to students who did not participate in simulation implementation in their undergraduate nursing program.

**Research Questions**

1. What effect does participation in a nursing program with simulation implementation have on critical thinking skills of undergraduate nursing students?
2. What is the difference between HESI exit exam critical thinking sub-scores of students who have participated in simulation compared with the HESI exit exam critical thinking sub-scores of students who have not participated in simulation?

Summary

Chapter one has introduced the problem, significance, purpose, and background of the study. The study’s hypothesis and research questions were identified. Chapter two includes the review of the literature, and the theoretical framework. This chapter will provide background on the topics of critical thinking, application to practice, and self-confidence and competence, related to simulation and undergraduate nursing students.

Chapter II

Review of Literature

The purpose of this integrative literature review was to assess literature documenting the effectiveness of the use of simulation in undergraduate nursing education programs on students’ critical thinking skills. This review included; empirical and conceptual literature, peer reviewed studies, and a doctoral dissertation. The 20 studies that were included in this review, were evaluated based on the relationship between simulation and undergraduate nursing students’ learning, with three themes emerging: knowledge acquisition/critical thinking, application to practice, and the relationship of self-confidence and competence. This integrative literature review provides findings, with level II through level IV evidence (Melnyk& Fineout-Overholt, 2011), that the use of simulation in nursing education can enhance students’ critical thinking skills and facilitate transfer of skills to practice. Further research to investigate the efficacy of simulation and undergraduate nursing students’ learning is necessary to ensure that active
learning strategies, such as simulation, provide a link from theory to practice, and engage the learner to provide a deeper understanding and transfer of knowledge.

**Search Strategy**

A literature search focused on identifying primary research articles published in English from 2009 to 2015 using The Cumulative Index of Nursing and Allied Health Literature (CINAHL), MEDLINE, Proquest, ERIC, PsychINFO, and Science Direct databases. The search terms included: undergraduate nursing students, simulation, and learning. Other search terms considered for this review included critical thinking, which provided a narrow search result, and knowledge, which provided a broad search result, so the term learning was used. The Boolean operator “OR” and “AND” were applied to expand the terms (see Table 1 and Table 2). Additionally, reference lists were hand searched for further studies. Inclusion criteria for review were: peer reviewed studies from 2009-2016 (due to a systematic review published in 2009), English language, and undergraduate nursing students. Excluded criteria were: studies prior to 2009 (with the exception of one study from 2006 which is considered a seminal study), non-English studies, simulation studies involving other disciplines, and computer or virtual simulations.

The initial search resulted in 214 potential papers; of these 147 were excluded based on inclusion and exclusion criteria. The remaining 67 papers were reviewed in detail and duplicates were deleted. Of the 63 that met the inclusion criteria, 44 were quantitative, 18 were qualitative, and one publically available dissertation was included. A summary of the search strategy is provided in Figure 1.

All quantitative studies were assessed using Bowling’s (2009) checklist of 20 evaluation criteria that assess study quality (see Table 3). Studies that met 14 or more items on the checklist...
were included in the review, for a total of 18 quantitative studies. Two studies (one a qualitative study and the other a mixed methods study) were identified and evaluated using Pearson’s (2004) critical appraisal instrument (see Table 4). Both studies were of high quality meeting eight of the 10 criteria. Each study was analyzed for its content, method, sample, findings, and limitations, in order to provide a standardized approach to synthesize the literature. The 20 studies were further evaluated based on their findings and implications for undergraduate nursing students’ learning, with three themes emerging; knowledge acquisition/critical thinking, application to practice, and the relationship of self-confidence and competence (see Table 5 and Table 6).

**Data Evaluation**

**Simulation Outcomes**

Simulation may provide more focused and deeper learning experiences to engage our undergraduate nursing students, yet the outcomes of simulation such as increased knowledge and critical thinking skills, easing transition to practice, and the relationship of confidence and competence, is still to be determined. The literature suggests that there is value in teaching skills in simulated environments, but some experts question the value in terms of student experience or in substituting clinical experiences with patients (Parr & Sweeney, 2006; Moule, Wilford, Sales & Lockyer, 2008; Shiavenato, 2009). Because of these contradictions, a need to review the literature was undertaken to explore the phenomenon of learning, and to consider the efficacy of simulation on the development of undergraduate nursing students’ critical thinking skills.

**Theme 1: Critical thinking**

One of the goals in education is to increase students’ knowledge. The first theme that emerged in this literature review was the relationship between simulation learning and critical thinking and clinical reasoning skills. The term critical thinking was defined differently in many
of the studies reviewed possibly due to the National League for Nursing mandate that all nursing programs develop and define critical thinking in relationship to their own nursing programs. Tanner (2006), notes that the term critical thinking is also used interchangeably with nursing process, clinical reasoning, clinical decision making, clinical judgment, and problem solving. Some of the studies reviewed used researcher developed instruments, based on their definition of critical thinking, which led to less than robust findings (Guhde, 2011; Jeffries & Rizzolo, 2006; Schlariet & Pollock, 2009). Some studies used instruments with established validity and reliability (Howard et al., 2010; Jeffries & Rizzolo, 2006; Miller et al., 2010; Shinnick et al., 2012; Sheppard et al., 2010), while other studies used researcher developed instruments with unreported psychometric testing (Burns et al., Hart et al., 2014; Nicholson, 2010; Swanson et al., 2011). Since the definitions of critical thinking may have been interpreted differently from those in this study and the Health Education Systems Incorporated (HESI) definitions, it may be difficult to generalize findings in this integrative literature review.

Several studies in this review examined the impact of simulation on critical thinking with undergraduate nursing students with varying results. Six studies (Burns, O’Donnell, & Artman, 2010; Hart, Brannan, Maguire, Brooks, & Robley, 2014; Howard, Ross, Mitchell, & Nelson, 2010; Miller, Leadingham, & Vance, 2010; Shepherd, McCunis, Brown, & Hair, 2010; and Swanson, Nicholson, Boese, Cram, Stineman, & Tew, 2011) with varied methods, tools, and sample sizes had consistent findings that simulation increased knowledge (a sub-set of critical thinking), in undergraduate nursing students. Burns, and colleagues (2010), used a prospective design with 114 first year undergraduate nursing students involving simulation using the nursing process. Findings indicate that simulation is useful as an adjunct to lecture, with students reporting significant (p<.001), increase in knowledge. Hart and colleagues (2014) used a mixed
method, quasi-experimental repeated measures descriptive design with 48 undergraduate nursing students, which focused on simulation scenarios designed to recognize and respond to acute patient deterioration. Findings from their study showed a statistically significant increase, (p<.001) in clinical reasoning, self-confidence, and team work. Videotaped guided debriefing revealed six themes relating to knowledge gains and simulation. The students noted that “hands on practice is essential in gaining confidence and clinical reasoning skills”. Howard and colleagues (2010), used a quasi-experimental, 2 group pre-test, posttest design to compare critical thinking skills between students in a simulation group and those using interactive case studies. Using the Health Education Systems Incorporated (HESI) custom examinations to measure outcomes, their findings show that the simulation group had significantly higher mean scores (p<.05) on HESI than the interactive case study group on posttests, and that the use of simulation can increase critical thinking and transfer to the clinical setting. An interesting finding was that the interactive case study groups’ mean HESI scores decreased, which the authors perceived as possibly due to the passive nature of the activity. Miller and colleagues, (2010) used a descriptive design with 43 nursing students in core nursing courses across the curriculum. The findings show that critical thinking and decision making skills improved following simulation scenarios, and provide a realistic tool for assessment. Shepherd and colleagues (2010), investigated the use of simulation as a teaching strategy using a longitudinal comparative quasi-experimental design with 28 senior students. Findings indicate that simulation as a teaching strategy contributes to students’ learning, an unexpected finding was that students lacked basic skills in measuring vital signs. The sixth study, which considered knowledge gains and undergraduate nursing students, was by Swanson and colleagues (2011) using an experimental post-test design with 144 baccalaureate second semester nursing students.
This study compared selected teaching strategies incorporating simulation and student outcomes. Findings indicate that during the simulation exercises students were able to demonstrate increased critical thinking and the ability to apply learned knowledge.

Three studies with moderate to large sample sizes, and varied designs and instruments, showed no significant difference in knowledge gains comparing simulation to another teaching strategy (Guhde, 2011; Jeffries & Rizzolo, 2006; and Sharliet & Pollock, 2009). In Guhde’s (2011) study, a survey design (based on the NLN framework) was used with 134 junior nursing students, comparing simple versus complex high-fidelity simulation scenarios. Findings from this study indicate that both scenarios improved student awareness of assessment skills, enhanced critical thinking and prioritization, and provided a link to learning objectives during the debriefing process. As previously mentioned, the National League for Nursing (NLN) and Laerdal Medical Corporation co-sponsored a national multisite and multimethod research study (Jeffries & Rizzolo, 2006), which sought to measure student satisfaction, self-confidence, cognitive gain (knowledge), and self-perceived performance with simulation. Despite the large sample (N=798), no significant knowledge gains were found; this may have been due to the limitations of the instrument used in this study. Additionally the students in this study had significantly higher satisfaction and confidence scores following simulation, but did not show differences on self-perceived performance. The authors conclude that HPS did provide valuable experiences for students to synthesize knowledge in a realistic way, but concluded that more research is needed in this area. Additional results from this seminal study provide a framework for design of future studies. Another study used a crossover design with equivalence testing with 74 undergraduate nursing students comparing simulation to a clinical experience. Findings show that simulation was found to be as effective as traditional clinical in promoting students’
knowledge acquisition and can be used in lieu of clinical placements (Scharliet & Pollock (2009).

Two studies evaluating knowledge gains found that learning only occurs when simulation is used in conjunction with another teaching strategy, such as lecture or self-reflection. Nicholson (2010), compared teaching strategies that promote active learning in nursing education using an experimental post-test design with 74 undergraduate nursing students. The findings indicate simulation with narrative pedagogy increases retention and performance, however this was an unpublished doctoral dissertation. The last study (Schinnick, Woo, Horwich, & Steadman, 2011), which evaluated knowledge gains, used a two groups repeated measures experimental design with 162 prelicensure nursing students to determine the importance of debriefing in simulation. Their findings indicate that gains in knowledge occur only after debriefing, based on the use of the California Critical Thinking Disposition Inventory (CCTDI) instrument in this study. Because of the aforementioned findings, the authors questioned whether the simulation component is necessary, or if self-reflection leads to knowledge gains. Based on the previous 11 study’s findings, ongoing research with larger sample sizes, using valid and reliable instruments, and comparing critical thinking and clinical reasoning in traditional clinical settings, simulated settings, and classroom settings are needed.

**Theme 2: Application to practice**

The second theme that emerged from this literature review was the relationship between simulation learning and its transfer to clinical practice. Seven studies in this review had findings that evaluated this relationship (Bambini et al., 2009; Debourgh & Prion, 2011; Ironside, Jeffries, & Martin, 2009; Kameg, Clochesy, Mitchell, & Suresky, 2010; Kaplan & Ura, 2010; Kirkman, 2013; and McCaughey & Traynor, 2010). Three studies used quasi-experimental designs, had
established assessment tools, large sample sizes, and had consistent findings that the use of simulation enhanced transfer of knowledge and skills to clinical practice (Bambini et al., 2009; Deborough & Prion, 2011; and Howard et al., 2010). Bambini and colleagues (2009) study used simulation to evaluate student outcomes for communication, confidence, and clinical judgment in an integrated quasi-experimental repeated measures design with 114 nursing students entering their first clinical experience. Findings indicate the use of simulation in preparation for clinical experiences provides a bridge between theory and practice and teaches skills such as delegation, prioritization, and critical thinking with the outcome of patient safety. DeBourgh and Prion (2011), used a quasi-experimental pre/posttest design with 264 nursing students in four cohorts over fifteen months. This study used simulation to teach nursing students to minimize patient risk and harm. Findings indicate simulation provides students with knowledge, skills, and challenges to apply to clinical practice. Howard and colleagues (2010), used a quasi-experimental pre/posttest design comparing interactive case studies with simulation in a study of 49 senior nursing students. The findings of this study indicate the use of simulation enhanced the link to learning objectives and outcomes, decreased anxiety, and showed a significant (p<.05) increase in the ability to transfer knowledge to the clinical setting. Ironside and colleagues (2009), multiple-patient simulation study used an exploratory design, (based on the NLN education simulation framework), with 413 associate and baccalaureate nursing students from urban and rural schools of nursing. The study findings indicate that immersing students in the care of multiple patients in a simulated environment increases the achievement and implementation of patient safety competencies.

Two studies (Kameg et al., 2010; and Kaplan & Ura, 2010), used students’ reports of self-efficacy and confidence to determine the effect of simulation and its application to clinical
practice. Kameg and colleagues (2010), developed a quasi-experimental design to compare traditional lecture with high fidelity human simulation in 38 pre-licensure nursing students in their mental health nursing course, and its effect on self-efficacy of communication skills. Their findings indicate that simulation is the preferred learning strategy and a valuable learning experience, and that knowledge and skills can be transferred to the clinical setting. Kaplan and Ura, (2010), evaluated simulation learning and its application to practice using a questionnaire and qualitative data with 97 senior nursing students in their final clinical rotation. Using multiple patient simulators in scenarios, they found that simulation enhanced prioritizing and delegating skills. Their findings indicate simulation did provide opportunities for prioritization and delegation, teamwork, and increased confidence, which can be applied to clinical practice.

The final two studies (Kirkman, 2012; McCaughey & Traynor, 2010), which evaluated the relationship of simulation and application to practice, had longitudinal designs with faculty developed tools, high attrition rates and inconclusive results. Kirkman (2013), used a time series design with 42 nursing students to evaluate nursing students’ transfer of learning. This study’s findings reveal that a combination of didactic, simulation, and clinical experiences increase the ability to transfer knowledge to clinical practice over time. McCaughey and Traynor (2010), used a descriptive longitudinal design with 93 undergraduate nursing students to evaluate the role of simulation in nurse education. The findings indicate that high fidelity simulation provides a valuable method of learning, which should impact transition to professional nursing practice, enhance patient safety, and enhance holistic care. It should be noted that despite the varied designs, methods, and tools used to evaluate the use of simulation and its application to clinical practice, the large diverse sample sizes included in the previous studies, level of evidence, and their findings, provide confidence for generalizability of these results.
Theme 3: Self-confidence and competence

The third theme that emerged from this literature review was that of the relationship of self-confidence and competence. Two studies sought to evaluate the relationship of students’ self-confidence and their demonstrations of competence in simulation performances with varied results. A study employed a quasi-experimental design, with 53 baccalaureate nursing students during their first laboratory experience, compared the use of low fidelity simulation (task trainers) to high fidelity manikins (human patient simulators) during simulation, and measured their perceptions of self-confidence (Blum, Borglund, & Parcels, 2010). The findings indicate that task trainers with return demonstration are as effective as high fidelity simulation when used with entry level nursing students, and that self-confidence increased as the semester progressed. Finally, a prospective pre/posttest design with 31 third-year nursing students compared knowledge and self-reported confidence with observed clinical performance (Liaw, Sherpbier, Reithans, & Klanin-Yobas, 2011). The findings from this study showed that there was an increase in self-confidence, but not performance, which may lead to potential danger with patient safety issues due to the over estimation of self-confidence. The previous studies comparing self-confidence to competence used varied tools, relied on student self-report, and had small sample sizes, which limits their findings’ generalizability.

Theoretical Framework

Benner’s (1984), model From Novice to Expert, provided a theoretical framework for identifying nursing knowledge acquisition and level of expertise, and underpins this study. This theory is based on The Dreyfus Model of Skill Acquisition (1982), which was originally developed for use with airline pilots, and looks at the advancement of skill performance based on experience, education, knowledge development, and career progression. Benner (1984),
introduced the concept that expert nurses develop skills and understanding of patient care over time through a sound educational base as well as a multitude of clinical experiences. Benner (1984), describes the five levels of nursing skill development experience as; novice (beginner with no experience), advanced beginner (demonstrates acceptable performance), competent (achieves greater efficiency and organization), proficient (learns from experiences what to expect in certain situations and how to modify plans), and expert (has intuitive grasp of clinical situations, performance is fluid, flexible, and highly proficient). Benner (1984), further proposed that the different levels of skill reflect changes in three aspects of skilled performance; that movement from abstract principles to using past experiences guide actions, that a change in the learner’s perception occurs and the ability to put separate pieces together as a whole develop, and that the learner is no longer an observer outside the situation, but is actively engaged in the situation. This experiential learning can be achieved through the use of simulation.

Research has indicated that providing learning environments that influence student engagement through the use of active learning strategies may enhance students’ retention and application of information and contribute to student success (Dewing, 2010). Active learning enables students to talk and listen, read, write, and reflect as they approach course content through problem-solving exercises, informal small groups, simulations, case studies, role-playing, and other activities, all of which require students to apply what they are learning (Meyers & Jones, 1993). Dewing (2008), states that active learning embeds critical thinking in the learner and encourages life-long learning to ensconce retention of knowledge and skills. Additionally, active learning helps students to achieve a higher level of learning, resulting in improved retention and social transfer of knowledge and skills into practice for the benefit of workplace culture, and ultimately for improving patient care (Dewing, 2010). Defining
attributes of active learning include: group work, critical thinking, participation and practice. Simulation learning environments use an active learning approach to provide a student-centered non-threatening learning environment, which provides students with the opportunity to develop psychomotor, cognitive, and affective competencies through trial and error.

There are a variety of definitions in the literature for critical thinking as it relates to nursing. The most common definition of critical thinking derived from a consensus of disciplines, which is used to ground teaching and assessment of critical thinking follows: "Critical thinking is the process of purposeful, self-regulatory judgment. This process gives reasoned consideration to evidence, contexts, conceptualizations, methods, and criteria.” (Facione, 1990). Tanner (2006), notes that critical thinking is associated with improved decision making, clinical judgement, and problem solving, resulting in safe, competent practice. Tanner’s Clinical Judgment Model (2006) builds upon Benner’s model of Novice to Expert by defining the thought processes nurses use when faced with complex situations. The Clinical Judgment Model identifies four dimensions of clinical judgment: noticing, interpreting, responding, and reflecting. This model focuses on the actions taken and reflection that occurs during a clinical situation, and its impact on the development of clinical knowledge through experience to apply to future situations (Tanner, 2006).

According to Benner et al., (2010), patient-centered care requires that students and practicing nurses are cognizant of the unique needs of patients and their caregivers. Contextualizing practice focuses student attention on the patient, a strategy designed to keep students thinking open and curious. Context is defined as the nature of the world in a given moment, including the lens we use to view the world in that moment. Engaging students in consideration of the contextual factors influencing a given clinical situation shifts the focus from
learners as doers of actions to learners as “meaning makers.” Meaning-making is accomplished through debriefing, and creates a greater awareness of relevant issues within context. The learner leaves the experience with a transformed understanding, allowing for improved practice (Forneris, 2004). While Benner did not develop a visual conceptual model, an interpretation has been created to demonstrate the movement from past abstract principals and past experiences, which change perceptions as the learner gains clinical expertise through building on the previous level.

Benner’s model asserts that experiences and knowledge provide opportunities for future clinical decision making based on critical thinking. Critical thinking contributes to the continuum moving students from novice to competent. The use of simulation as an active learning experience provides opportunities for knowledge and experience, enhances critical thinking, and can be applied to future clinical situations. HESI exit exam items are written at the application or higher levels of cognitive ability, according to Bloom’s taxonomy (1956), which evaluate critical thinking. The HESI exit exam is based on blueprints for NCLEX-RN licensing exam. HESI exit exams and NCLEX measure constructs that are essential to entry-level nursing practice and competence, such as the ability to use clinical judgement, and apply knowledge to clinical practice situations. This researcher’s interpretation of the relationship between Benner’s model, simulation learning, the HESI and NCLEX exams, and critical thinking can be found in Figure 2.

**Theoretical Definitions**

For this integrative review, the term critical thinking will be defined as; “the process of purposeful, self-regulatory judgment. This process gives reasoned consideration to evidence, contexts, conceptualizations, methods, and criteria.” (American Philosophical Association Delphi Report [APA], Facione, 1990). The six core critical thinking skills are; interpretation, analysis, evaluation, inference, explanation, and self-regulation (Facione, 1990). Watson and
Glaser (1980), define critical thinking as a process of analyzing, synthesizing, and evaluating information collected through observation, reflection, experience, or communication that may lead to a belief or action. Another definition includes reasonable and reflective thinking, focusing on comparing decision alternatives (Ennis & Millman, 1985). The above definitions have the following attributes of critical thinking in common: the association of knowledge, reasoning, cognitive skills, identification, and exploration of alternative frames of reference.

Clinical reasoning and clinical judgment are key pieces of critical thinking in nursing. In a review of over 200 articles, Tanner (2006), developed the model “Thinking Like a Nurse”, and defined clinical judgment as an interpretation, or conclusion, about a patient’s needs, concerns, or health problems, and/or the decision to take action (or not), use or modify standard approaches, or improvise new ones as deemed appropriate by the patient’s response. Tanner (2006), also defined clinical reasoning as the processes by which nurses and other clinicians make their judgments, and includes both the deliberate process of generating alternatives, weighing them against the evidence, and choosing the most appropriate. The American Association of Colleges of Nursing emphasize critical thinking in their Essentials of Baccalaureate Nursing, and state that course work and clinical experiences should provide the use of clinical judgment and decision-making skills (AACN, 2006). Critical thinking has also been identified as a top priority, when evaluating gaps between academic preparation and practice (Nursing Executive Center, 2008). Nursing students must think critically in order to recognize changes in patient conditions, anticipate complications, interpret assessment data, facilitate decision-making, and recognize when to ask for help (Nursing Executive Center, 2008).

There are few studies that examine the relationship between simulation learning and an objective measurement in the change in student learning outcomes. Kaddoura’s (2010)
qualitative study provided findings from simulation research on the self-perceptions of critical thinking development by new graduate nurses: “Clinical simulation sharpens nurses’ critical thinking skills through hands-on experiential learning, observation of psychomotor skills, videotaping scenarios, and debriefing. It helps to develop effective communication skills, provide constructive feedback, promote working cooperatively as part of a team, and foster delegation and other leadership skills”.

Operational Definitions

- Critical thinking sub-scores are defined by HESI as the measure of a student’s ability to use critical thinking skills necessary for clinical decision making and judgment, are based on concepts derived from critical thinking theory (Paul, 1990), and are consistent with the critical thinking definition in the APA Delphi report.

- A traditional student is a nursing student enrolled in a baccalaureate nursing program over the course of four years of college study. These students are primarily young (age less than 22 years), and female. Traditional students take a standardized nursing entrance exam (HESI A2), prior to the beginning of their sophomore year.

- Accelerated students, or non-traditional students, have a previous undergraduate degree and are pursuing a second undergraduate degree in nursing. These students are more mature (age greater than 22 years), include more male students, and bring previous life experience to their education. Accelerated degree programs vary in length from one to two years. The sample for this proposed study has students who are full time and complete the program in one year, as well as part time students who complete the program in two years. Students are admitted to the accelerated program after successful
completion of six prerequisite courses (psychology, statistics, human anatomy and physiology I and II, microbiology, and chemistry).

- Simulation is defined as a pedagogy using one or more typologies to promote, improve and/or validate a participant’s progression from novice to expert (Benner, 1984).
- Fidelity refers to the extent to which the simulation model resembles a human being.
- A simulation learning environment is an atmosphere that is created by the facilitator to allow for sharing and discussion of participant experiences without fear of humiliation or punitive action. The goals of the simulation learning environment are to promote trust and foster learning, (International Nursing Association for Clinical Simulation and Learning [INACSL], 2013).
- A facilitator is an individual who guides and support participants toward understanding and achieving objectives (International Nursing Association for Clinical Simulation and Learning [INACSL], 2013).
- Debriefing is defined as an activity that follows a simulation experience and is led by a facilitator. Participant reflective thinking is encouraged, and feedback is provided regarding the participants performance while various aspects of the completed simulation are discussed. The purpose of the debriefing is to move toward assimilation and accommodation in order to transfer learning to future situations (National League for Nursing [NLN-SIRC], 2010).
- Health Education Systems Incorporated (HESI), examinations are comprehensive nursing assessments (based on the National Council Licensure Exam [NCLEX], test blueprints and American Association of Colleges of Nursing [AACN], Baccalaureate Essentials), to define the constructs indicative of behaviors required for entry-level practice. HESI item
writers create test items for use on HESI exams that specifically measure these behaviors and assess student competency and evaluate achievement of curricular outcomes (Morrison, Adamson, Nibert, & Hsia, 2004). The conceptual framework used to develop HESI exams are grounded in classical test theory and critical thinking theory, and are created at the application and analysis levels of Bloom’s Taxonomy (Elsevier, 2011).

- HESI exit exams provide an overall composite score that assesses nursing knowledge required for entry level practice, with subject area scores in over 50 content areas in the following categories; nursing process, client needs, specialty and sub-specialty areas, AACN curriculum categories, NLN educational competencies, Quality and Safety Education for Nurses (QSEN), and nursing concepts (Elsevier HESI Assessment, 2016).

**Limitations**

While the findings of this integrative literature review add to the body of literature evaluating critical thinking skills and simulation efficacy with undergraduate nursing students, some limitations were noted. Limitations include several studies with small homogenous samples, studies that used researcher developed tools with unreported reliability and validity, and studies that used designs that provided subjective data from student perceptions, which may have affected outcomes (see Table 7). Another limitation was the differing definitions of critical thinking based on using established instruments, and studies that used instruments developed by the researchers without psychometric data (see Table 7). Additional limitations were the exclusion of simulation in other disciplines, as the focus for this review is undergraduate nursing education, and simulation studies prior to 2009.
Discussion

Nurse educators must strive to engage students in active learning processes to achieve deeper levels of learning. Simulation may provide this experiential learning experience. Despite the fact that simulation has been utilized in nursing education for the last three decades there is limited research as to the effectiveness of simulation. This integrative literature review describes significantly positive findings in 15 of the 20 studies reviewed (Bambini et al., 2009; Burns et al, 2010; DeBourgh & Prion, 2011; Guhde, 2011; Howard et al., 2010; Ironside et al., 2009; Kameg et al., 2010; Kaplan & Ura, 2010; Miller et al., 2010; Schinnick et al., 2011; Schlariet & Pollock, 2009; Shepherd et al., 2010; Sullivan-Mann et al., 2009; and Swanson et al., 2011), which consistently support the use of simulation as an active learning strategy that increases critical thinking and clinical reasoning skills.

This review also provides evidence that simulation can be used to enhance undergraduate nursing students’ deeper learning, increased knowledge acquisition, and transfer of skills to the clinical setting. The experimental designs (which provide level II, III and IV evidence), large sample sizes (N=28-798), diversity of samples, and significant findings of these studies, provide evidence and confidence for generalizability of the results. Three of the studies reviewed (Jeffries & Rizzolo, 2006, Kirkman, 2013; and McCaughey & Traynor, 2010), had inconclusive results possibly due to the study design and researcher developed tools used, while two additional studies (Blum et al., 2010; and Liaw et al., 2011), did not provide significant evidence to support the relationship between student self-confidence and competence. Recommendations for further research with large samples, reliable and valid instruments, and outcome measurements such as critical thinking, and transferability of skills, need to be conducted in order to better assess the efficacy of simulation in undergraduate nursing education.
Conclusion

In an increasingly complex healthcare environment, nursing students need to be able to focus on the many aspects of clinical situations, solve problems, and make critical decisions in nursing care. This integrative literature review in chapter two provides preliminary support for the use of simulation in nursing education to facilitate students’ skill development, which is integral in transforming a nursing student into a professional nurse. This review also provides evidence to suggest that the use of simulation improves learning outcomes related to critical thinking, and may impact patient outcomes positively in the future. Additionally, students prefer this learning strategy as an active learning methodology. Simulation experiences allow students to practice critical thinking and skills, without compromising patient safety. While some evidence from this review supports critical thinking related to simulation, and other studies provide insights but not evidence, none have addressed this study’s research question. Further research to investigate the efficacy of simulation with undergraduate nursing students’ critical thinking skills is necessary to ensure that active learning strategies such as simulation, provide a link from theory to practice, and engage the learner to provide a deeper understanding and transfer of knowledge. Additionally, given that the HESI is accepted as a reliable and valid measure for critical thinking, future research is needed with multisite studies to establish an evidence base for simulation in undergraduate nursing curricula. Chapter three will describe the methodology and procedures for the study.

Chapter III

Methodology

The review of the literature in Chapter II provides evidence for the use of simulation in undergraduate nursing programs. While the research reviewed focused on critical thinking,
application to practice, and confidence and perceived competence, objective measures of learning and critical thinking outcomes using simulation are lacking. This chapter will describe the study’s methodology.

This study used a quasi-experimental design with a historical control group to evaluate Health Education Systems Incorporated (HESI) exit exam critical thinking sub-scores from cohorts of graduating baccalaureate nursing students from two time periods: prior to the implementation of simulation, and after the implementation of simulation in a private urban university in the northeast United States. The HESI tests provide an external independent assessment of a student’s competency (using Bloom’s taxonomy) at the higher cognition level of application, analysis, and synthesis (Morrison, Nibert, & Flick, 2006). An example of a simulation scenario used in this research study, which comprises the three domains of learning: psychomotor, affective, and cognitive, can be found in Appendix B.

Research Design

This study compared critical thinking skills measured by the Health Education Systems Incorporated (HESI) exit exam critical thinking sub-scores of cohorts of nursing graduates from one nursing program, prior to the implementation of simulation into the curriculum, to cohorts of nursing graduates following the implementation of simulation into the curriculum. The HESI exit exam is based on the nursing process and Quality and Safety Education for Nurses (QSEN) Competencies for assessment of student learning. The nursing process and QSEN competencies are integral components of the American Association of Colleges of Nursing (AACN) Baccalaureate Essentials, which the National Council of State Boards of Nursing uses as a template for the National Council Licensing Exam (NCLEX) as well as for curricular design in many schools of nursing, including this university. Analysis of this data may prove vital to
schools of nursing to determine if simulation education has an effect on students’ critical thinking skills, and can help to determine the optimal combination of simulation and clinical time in nursing programs. The findings of this study may: (a) provide insight into the use of simulation and its’ relationship to critical thinking to enhance learning; and (b) may strengthen current nursing programs to provide meaningful learning experiences in the education of nursing students that can impact patient safety in the future.

**Research Questions**

1. What effect does participation in a nursing program with simulation implementation have on critical thinking skills of undergraduate nursing students?

2. What is the difference between HESI exit exam critical thinking sub-scores of students who have participated in simulation compared with the HESI exit exam critical thinking sub-scores of students who have not participated in simulation?

**Research Measures**

This quasi-experimental two group pre-post design compared student nurse graduates critical thinking skills from cohorts prior to the implementation of simulation, to cohorts after the implementation of simulation in an undergraduate nursing program. Critical thinking scores were measured using a computerized exit exam developed by HESI, which provides a high degree of reliability and validity in assessing students’ progress through the nursing program, and their preparedness for the licensing examination (Langford & Young, 2013). As a measure of the HESI test’s reliability, a Kuder Richardson Formula 20 is calculated for every exam administered, the reliability coefficients for the HESI exit exams range from 0.96 to 0.99. Content validity refers to the effectiveness of the test items in measuring the basic nursing knowledge and skill of students. HESI uses course syllabi from nursing programs and NCLEX test blueprints to define the content.
for the HESI exit exam. This study used results from the standardized HESI exit exam. The NCLEX examination assesses the knowledge, skills and abilities that are essential for the entry-level nurse to use in order to meet the needs of clients requiring the promotion, maintenance or restoration of health (National Council of State Boards of Nursing [NCBSN], 2013). Bloom’s taxonomy for the cognitive domain is used as a basis for writing and coding items for the exit examination (Bloom, 1956). Since the practice of nursing requires application of knowledge, skills and abilities, the majority of items are written at the application or higher levels of cognitive ability, which requires more complex thought processing. The content of the NCLEX-RN Test Plan is organized into four major Client Needs categories. The categories are: Safe and Effective Care Environment, Health Promotion and Maintenance, Psychosocial Integrity, and Physiological Integrity. Construct validity refers to the extent to which a test measures specified traits or attributes at an abstract level. HESI exit exams measure constructs that are essential to entry-level nursing practice, such as critical thinking.

The increased use of HESI exit exams by schools of nursing suggest the institutions find these exams worthwhile evaluation tools for measuring student outcomes within particular nursing programs (Elsevier, 2016). Additionally sufficient scientific data exist to reassure nurse educators that HESI exit exams can be used confidently to assess students’ progress throughout the nursing curriculum, and their preparedness for the licensure exam (Nibert, Young, & Adamson, 2002). Students’ total scores on the examinations are reported as HESI scores, and are calculated using a mathematical model that has been applied to the raw data. The HESI exit exam reports results in the form of a conversion score. This score is based on the average weight of all test items answered correctly, and is used as a component of a student’s final course grade in many nursing programs.
including the university in this study. Evidence and theory support the interpretation, and use, of HESI critical thinking sub-scores in this proposed study to measure student learning outcomes.

Sample and Setting

The population for this study was drawn from an intact sample. The number was based on graduating cohorts of students, and consists of HESI exit exam critical thinking sub-scores, demographic data (age, gender, and ethnicity), and data required for admission to the program (cumulative grade point average [GPA] from pre-requisite courses for accelerated students, and HESI nursing admission assessment [A2] composite scores for traditional students in their sophomore year), from a private university in the northeast United States. The baseline GPA and HESI A2 scores were used to compare homogeneity among the cohorts prior to starting their nursing program. The sample population is not as diverse as the university’s population, as it is predominantly female. The university is located in an urban community and is considered a commuter campus. The nursing program is accredited by the Commission on Collegiate Nursing Education. The curriculum at this university identifies the professional nursing standards and guidelines from the Essentials of Baccalaureate Nursing (AACN, 2008), Quality and Safety Education for Nursing (QSEN) Competencies, the NCLEX test plan, and the American Nurses Association Code of Ethics.

Ethical Considerations

Permission to conduct this study was received from the Institutional Review Boards (IRB) of the College of Health Profession at Pace University, and the City University of New York, Lehman College. All demographic data and exam scores have been de-identified. There is no potential harm to participants of this study. Permission from Elsevier to use the university’s scores from graduated cohorts was obtained.
Data Collection

After obtaining permission from the respective IRB’s, student scores from the HESI exit examination was obtained from the Registered Nurse Specialty Examination Reports found on the Elsevier Web site, faculty section (Elsevier, 2016). In addition, the Nurse Researcher Agreement to Participate in Elsevier/HESI Educational Research Projects form was obtained (Appendix C) prior to the collection of student scores from the HESI exit exam. Students’ demographic data, including age, gender, and ethnicity, were obtained from the registrar’s office at Pace University. All data has been coded to ensure privacy and confidentiality of the participants, and has been kept in a locked file cabinet during the time of data analysis and for one year after.

Data Analysis

Data analysis, using SPSS, was used to analyze demographic data, to determine homogeneity at baseline, and also compared within and between group differences with HESI critical thinking sub-scores for the graduate cohorts. Bivariate inferential statistical analysis includes independent t-tests and multiple linear regression to determine the relationship between simulation and critical thinking skill development. G power was used to conduct a priori power analysis to calculate sample size. For a power of 0.80 with an alpha of 0.05 and a moderate 0.5 effect size, it was determined that a minimum sample of 128 student scores was needed.

Aims

Researchers note the lack of reliable tools to measure learning, this is evident in the paucity of research linking knowledge gains and simulation (Jeffries, 2007; Kneebone, 2003; Nehring 2008). Previous studies have focused on student and faculty perceptions and preference for simulation as a teaching-learning approach, but have not focused on the learning that has occurred (Bambini, Washburn, & Perkins; Blum, Borglund, & Parcells, 2010). The aim of this
quasi-experimental study was to determine what effect simulation implementation has on nursing students’ critical thinking skills, as measured by the HESI exit exam critical thinking sub-scores from undergraduate nursing graduate cohorts. Findings from this study may evaluate the efficacy of simulation on the development of critical thinking skills in nursing students, which may affect their nursing practice and impact patient outcomes.

**Assumptions**

The study had the following assumptions:

1. The HESI exit exam (a valid and reliable standardized exam), will measure students’ critical thinking skills and achievement of learning outcomes.

2. Simulation experiences and clinical experiences provide knowledge and skills to undergraduate nursing students, and achievement of critical thinking.

3. No substantive curriculum changes have taken place in the study’s nursing program during the time of the study.

**Delimitations**

The study had the following delimitations:

1. Only students who have completed a nursing program (traditional or accelerated) from the university in the years stated previously will be included in this study.

**Limitations**

The study had the following limitations:

1. The study evaluated a convenience sample of HESI exit exam critical thinking sub-scores from students who have graduated from a nursing program in a private university in the northeast United States during the years 2011 and 2014.
Summary

This chapter described the quasi-experimental design, research questions and research measures, sample and setting, ethical considerations, data collection and data analysis, aims, assumptions, delimitations and limitations. The rationale for the research design, reliability and validity of the research measures, and analysis rigor were described.

Chapter IV

Results

This chapter presents the results of the data analysis, including the quantitative results and answers to the research questions. Demographics are described and key findings are highlighted. The purpose of this study was to evaluate the effect of simulation implementation on nursing students’ critical thinking skills as measured by Health Education Systems Incorporated (HESI) exit exam critical thinking sub-scores from cohorts of graduated students.

The data gathered included a comparison of HESI critical thinking sub scores from two academic years, in a baccalaureate nursing program: 2011 (prior to the implementation of simulation) and 2014 (after the implementation of simulation).

In the proposed study, I intended to obtain grade point averages [GPA] from pre-requisite courses for accelerated students, and nursing HESI admission assessment [A2] composite scores for traditional students, to compare homogeneity of cohorts at baseline. I was unable to obtain the above mentioned sample data from the university’s admissions departments. This information was not computerized, and was not able to be located manually. Instead, the comparisons for cohort homogeneity were based on the minimal requirements for admission to each nursing program. For admission to the traditional nursing program, the students are required to have a minimum high school average of 80. For admission to the accelerated
program, the students are required to have a minimum GPA for pre-requisite courses of 3.0. All student scores included in this study met the above criteria.

**Descriptive Analysis**

The HESI exit exam critical thinking cohort scores were compared for differences in mean scores with a t-test. The scores were analyzed for normal distribution with tests for skewness and kurtosis. The relationship between accelerated and traditional students with and without simulation, and their scores on critical thinking were compared using a 2x2 between subjects analysis of variance (ANOVA). Using SPSS statistical software, a total of 218 students were included in the analysis. A power analysis was completed for the proposed study using the G* Power program, and a minimum sample size of 128 students was determined to be necessary to detect if a significant relationship exists. The power analysis calculation was completed using the acceptable power level of 0.80, moderate effect size ($r = 0.50$) and $\alpha = 0.05$.

**Sample**

Students were defined as either traditional or accelerated students with exposure to simulation or no exposure to simulation. There were a total of 115 (52.8%) traditional students and 103 (47.2%) accelerated students, and 112 (51.4%) that had simulation, and 106 (48.6%) students that did not have simulation. There were 204 students that responded to demographics questions and 14 that did not. The average age of students was 32.17 years old (SD=8.43) with a range of 23-64 years old. There were 192 (83.5%) female, and 21 (9.6%) male, with 121 (55.5%) self-reported race/ethnicity as being white/Caucasian. Self-reported race/ethnicity of all other non-white participants was less than 5% each. An additional analysis of the demographics was conducted to examine the differences between traditional and accelerated students. The
average age of traditional students was 29.69 years old (SD=6.03), and the average age for accelerated students was 35.38 years old (SD=9.90). See Table 7 for all student demographics.

**Hypothesis Analysis**

**Hypothesis**

*There will be a statistically significant difference in HESI exit exam critical thinking sub-scores (which measure the student’s ability to use critical thinking skills necessary for clinical decision making and judgment) for students who participated in an undergraduate nursing program with simulation implementation when compared to students who did not participate in simulation implementation in their undergraduate nursing program.*

The HESI exit exam is a 150 question examination that contains between 120-130 questions specifically related to critical thinking, with the remaining 20-30 questions related to the knowledge and comprehension levels of Blooms Taxonomy (1956). A total score of less than 850 requires further preparation, 850-900 is considered to be acceptable, and above 900 is the recommended critical thinking score. To analyze this hypothesis, an independent samples t-test was used. The independent samples t-test violated the homogeneity of variance ($F = 4.2$, $p<0.05$), so equal variances not assumed were utilized to correct for this violation. The average critical thinking skill score for simulation exposure ($\bar{X} = 867.04$, $SD = 99.33$) was higher than the no simulation exposure ($\bar{X} = 841.64$, $SD = 121.74$), but this was not statistically significant ($t_{(202.8)} = 1.68$, $p=0.09$). Additional analyses, were conducted to determine if the data was normally distributed. The skewness statistic for simulation exposure was -0.068 and for no simulation exposure was -0.222, and the kurtosis for simulation exposure was -0.036 and for no simulation exposure was 0.343. These two statistics indicate that the critical thinking scores are normally distributed. A box plot (see Figure 3) was created to examine the variability within the distribution. The box plot showed the variability within critical thinking scores, with a larger
variability in the group not exposed to simulation as opposed to the group exposed to simulation. There were also two potential outliers within the distribution (see Figure 3). An additional analysis examining the 5% trimmed mean to reduce the variability and eliminate outliers found that in the simulation exposure group the mean critical thinking score was 867.28 and in the group not exposed to simulation the mean score was 844.48. Although there were no statistically significant differences found for simulation exposure versus no simulation exposure and its impact on critical thinking scores, the mean critical thinking scores were higher in the simulation group. See Table 8 for means and standard deviations and Figure 4 for critical thinking scores.

Research Questions

Research Question 1

*What effect does participation in a nursing program with simulation implementation have on critical thinking skills of undergraduate nursing students?*

The first research question measured the difference between accelerated and traditional students on critical thinking scores. To answer this question, an independent t-test was conducted. The average critical thinking skill score for traditional students exposed to simulation ($\bar{x} = 843.34$, SD = 118.83) was lower than the accelerated students exposed to simulation ($\bar{x} = 867.36$, SD = 101.23), but this was not statistically significant ($t_{(216)} = 1.60$, p=0.11). The skewness statistic for accelerated students was 0.122 and for traditional students was -0.353, and the kurtosis for accelerated students was -0.501 and for traditional students was 0.547.

These two statistics indicate that the critical thinking scores are normally distributed. A box plot (see Figure 4) was created to examine the variability within the distribution. The box plot shows that the variability within critical thinking scores for the traditional students is larger
than the accelerated students. There were also two potential outliers within the distribution (see Figure 4). An additional analysis examining the 5% trimmed mean to reduce the variability and eliminate outliers found that in the accelerated students mean critical thinking score was 866.21 and the traditional students mean score was 846.17. Although there were no statistically significant differences found for accelerated students versus traditional students and the impact on critical thinking, the mean critical thinking scores were higher for the accelerated students. See Table 9 for means and standard deviations.

**Research Question 2**

What is the difference between HESI exit exam critical thinking sub-scores of students who have participated in simulation compared with the HESI exit exam critical thinking sub-scores of students who have not participated in simulation?

The second research question examined the relationship between accelerated and traditional students exposed to simulation (experimental groups) and those not exposed to simulation (control groups) and their critical thinking scores. To analyze this relationship, a 2x2 between subjects analysis of variance (ANOVA) was conducted. The results for the main effect of student type (F(1,214) = 2.09, p=0.15) with simulation (F(1,214) = 2.19, p=0.14), and the interaction effect of student type without simulation (F(1,214) = 0.41, p=0.53) were not statistically significant. However, the overall averages for simulation exposure with accelerated students (\(\bar{x}= 872.81, SD = 104.27\)) and traditional students (\(\bar{x}= 860.60, SD = 94.11\)) were both higher, but not statistically significant compared to the accelerated students who were not exposed to simulation (\(\bar{x}= 860.05, SD = 97.72\)), and traditional students who were not exposed to simulation (\(\bar{x}= 828.58, SD = 135.50\)). See Table 10 for means and standard deviations and Table 11 for 2x2 ANOVA.
Summary

This chapter presents the findings from this quasi-experimental study with a historical control group. Although the findings did not provide statistically significant results to support the hypothesis and research questions, critical thinking sub-scores did increase in all cohort groups. The next chapter will provide a discussion of the study’s findings and its implications.

Chapter V

Summary and Conclusion

Summary of Problem

In our complex healthcare environment, effective education of undergraduate nursing students is challenging. The Joint Commission (Excellence, 2014) emphasizes the importance of high quality, safe nursing care. In order for our students to become knowledgeable, competent practitioners, their education must include the development of critical thinking, and the ability to apply classroom knowledge to clinical practice. Traditional methods of teaching and learning (such as lecture and PowerPoint presentations), do not allow for the application of theory or repetition of skills and practice necessary for the current environment of clinical nursing practice (Brannan, White, & Bezanson, 2008). The use of simulation of clinical situations is an active-learner centered teaching strategy that can provide opportunities for nursing students to apply and synthesize classroom knowledge in realistic and non-threatening environments (Jeffries & Rizzolo, 2006). Critical thinking and clinical decision making involve the application of knowledge and experience to identify patient problems, and to direct clinical judgments and actions that result in positive patient outcomes (Benner, Hughes, & Sutphen, 2008). Research on the relationship between simulation learning and the development of critical thinking skills in nursing students is integral, in order to improve patient outcomes. Many studies have focused on
the relationship between use of simulation and students’ self-efficacy, self-confidence, and satisfaction with this teaching strategy (Jeffreys & Rizzolo, 2006; Kameg et al., 2010; Kaplan & Ura, 2010; Blum et al., 2010; and Liaw et al., 2011). However, few studies have investigated the relationship between the use of simulation and development of knowledge or critical thinking. A review of simulation outcomes conducted by Lapkin, Levett-Jones, Bellchambers, and Fernandez (2010), included over 1,600 studies between 1999 and 2009 in the initial search, but only eight studies met the inclusion criteria for their review. The researchers found that simulation improved critical thinking, skills performance, and knowledge of subject matter. An increase in clinical reasoning was inconclusive, although the components of clinical reasoning; critical thinking, prioritization, and clinical decision making, did improve with simulation. These findings are consistent with previous reviews, and are not exclusive to nursing simulation research. Issenberg’s et al., (2010), review of 34 years of medical simulation literature concluded “While research in this field needs improvement in terms of rigor and quality, high-fidelity medical simulations are educationally effective and simulation-based education complements medical education in patient care settings”. Many of the literature reviews on simulation outcomes reach a common conclusion and agree that variability in study design, issues with sample sizes that cannot detect a significant effect size, and an overall lack of controlled, longitudinal studies make it difficult to draw strong conclusions as to the effectiveness of simulation (Hayden et al., 2014). The necessity to measure knowledge gains in nursing students exposed to simulation learning is integral to ensure that nursing programs are preparing students for practice in our current healthcare environment.
Purpose Statement

The purpose of this study was to evaluate the effect of simulation implementation on nursing students’ critical thinking skills as measured by Health Education Systems Incorporated (HESI) exit exam critical thinking sub-scores from cohorts of graduated students. HESI critical thinking sub-scores, measure the student’s ability to use critical thinking skills necessary for clinical decision making and judgment (Howard et al., 2010; Morrison, Nibert, & Flick, 2006). The student scores were compared between two academic years; prior to the implementation of simulation, and after the implementation of simulation, in a private university’s baccalaureate nursing program. This research study was conducted with historical data from a private university’s baccalaureate nursing program in the northeast United States, after implementation of human patient simulation learning experiences throughout the nursing curriculum as an adjunct to the students’ didactic and clinical experiences. Benner’s (1984), model From Novice to Expert provided a framework for this study.

Sample

Students were defined as either traditional (52.8%) or accelerated (47.2%), and exposure to simulation (51.4%) or no exposure to simulation (48.6%). The average age of students was 32.17 years old (SD=8.43) with a range of 23-64 years old. The sample was predominantly female, (83.5%), with (9.6%) male, and (55.5%) self-reported race/ethnicity as being white/Caucasian. While this study’s sample reflects gender demographics consistent with comparable baccalaureate nursing programs, it also includes a more diverse sample (44%) as compared to national statistics (30%), which may affect generalizability. The reported diversity (self-reported ethnicity other than white/Caucasian) percentage for the state in which this study was conducted is 39% for baccalaureate enrollment for the years 2011-2015 (AACN, 2016). An
additional analysis of student demographics was conducted to examine the differences between traditional and accelerated students. The average age of traditional students was 29.69 years old (SD=6.03) and the average age for accelerated students was 35.38 years old (SD=9.90). See Table 7.

Hypothesis

There will be a statistically significant difference in HESI exit exam critical thinking sub-scores (which measure the student’s ability to use critical thinking skills necessary for clinical decision making and judgment) for students who participate in an undergraduate nursing program with simulation implementation when compared to students who did not participate in simulation implementation in their undergraduate nursing program.

The hypothesis states that there will be a statistically significant difference in HESI critical thinking sub-scores for nursing students who participated in simulation versus nursing students who did not participate in simulation. The study had the following assumptions; the HESI exit examination is a comprehensive nursing assessment developed to test and measure students’ critical thinking, and is created at the application and analysis levels or higher according to Bloom’s Taxonomy (Elsevier, 2011). That simulation experiences provide practice of knowledge and skills to undergraduate nursing students in a safe environment, and achievement of critical thinking. Additionally that no substantive curriculum changes were made during the study’s time frame and faculty teaching didactic courses and simulation were consistent. HESI examinations were previously incorporated into the curriculum at the school of nursing prior to the implementation of simulation, and the scores on the HESI examination are used as a measurement of learning outcomes in most courses in the curriculum. Passing the
HESI examination indicates that the students have “the minimum competencies needed to perform safely and effectively as a newly licensed, entry-level nurse” (NCSBN, 2014).

While the results of the HESI exit examination critical thinking sub-scores were not statistically significantly different in students who participated in simulation (867.04) versus students who did not participate in simulation (841.64), the scores did increase by 26.4 points (3%) after simulation implementation and the students achieved HESI critical thinking sub-scores in the acceptable range (850-900). Before simulation implementation in this undergraduate nursing program, the HESI exit examination critical thinking sub-scores were below a passing benchmark of 850. The use of cohort historical data will be discussed in the study’s limitations, however higher HESI exit examination sub-scores may provide evidence that simulation implementation can be an effective learning strategy to increase critical thinking skills in undergraduate nursing students.

**Research Question One**

*What effect does participation in a nursing program with simulation implementation have on critical thinking skills of undergraduate nursing students?*

The first research question assessed the difference between participation in an undergraduate nursing program with simulation implementation and its relationship to critical thinking sub-scores in traditional and accelerated nursing students. Statistical analysis of the results show that the average HESI critical thinking sub-score for traditional students exposed to simulation (843.43), was lower than the accelerated students exposed to simulation (867.36), but this was not considered statistically significant. Of note in the above findings, was the large range of HESI critical thinking sub-scores. The variability with critical thinking sub-scores for the traditional students (score range 535) was larger than the accelerated students (score range
381), see Figure 3. Further discussion of the variability of critical thinking sub-scores in traditional versus accelerated nursing students will be explored in the limitations section.

**Research Question Two**

*What is the difference between HESI exit examination critical thinking sub-scores of students who have participated in simulation compared with the HESI exit exam critical thinking sub-scores of students who have not participated in simulation?*

The second research question examined the relationship between accelerated and traditional students exposed to simulation and those not exposed to simulation and their HESI critical thinking sub-scores. The results for the main effect of student type with simulation, and the interaction effect of student type without simulation were not statistically significant. However, the overall averages for simulation exposure with accelerated students (872.81) and traditional students (860.60) were both higher, but not statistically significant compared to accelerated students who were not exposed to simulation (860.05), and traditional students who were not exposed to simulation (828.58). Despite an increase in students critical thinking sub-scores after the implementation of simulation, there were minimal differences in the correlations when comparing the HESI exit examination critical thinking sub-scores before and after the addition of simulation to the nursing program.

**Summary of Research Findings and Discussion**

Previous research on the learning outcomes of simulation in nursing education call for more studies with large sample sizes, experimental designs, and the use of objective valid and reliable instruments to measure the learning that has occurred. Few studies focus on knowledge acquisition after the implementation of simulation in an undergraduate nursing program. Findings from this study (while not statistically significant), provide evidence that the use of the
HESI exit examination (a valid and reliable instrument), can be used for objective measurement of student learning. This study’s findings of positive trends with increasing mean critical thinking sub-scores after the implementation of simulation in cohorts of graduated students, provide evidence for the use of simulation in undergraduate nursing education. This research demonstrates improved student outcomes as measured by the HESI exit examination critical thinking sub-scores, which may be an indication of an improvement in knowledge acquisition after the implementation of simulation, and may impact patient safety in the future.

In a review of the relevant literature, no studies measured the learning that occurred when students were exposed to simulation as an adjunct to didactic and clinical experiences. Additionally, research on simulation learning outcomes are equivocal in measuring nursing student knowledge acquisition (Jeffries & Rizzolo, 2006; Hayden et al., 2014). The addition of simulation learning experiences in this researcher’s nursing program provided the opportunity to explore that relationship with the use of historical data, and an objective measurement to assess student learning. According to Benner et al., (2008), simulation as a teaching strategy enable student nurses to think critically and give students the opportunity to practice in a safe environment, providing experiences that would be impossible to capture in actual practice situations with patients.

Benner’s (1984) model of skill acquisition, provided an accurate and useful theoretical framework for this study. This model looks at the advancement of skill performance based on experience, education, knowledge development, and career progression (Benner, 1984). Benner asserts that expert nurses develop skills and understanding of patient care over time through a sound educational base as well as a multitude of clinical experiences. Additionally, Benner postulates that undergraduate nursing students cannot surpass the competent level prior to
graduation. Some researchers say the true learning with simulation occurs during the debriefing, when students self-identify and reflect on ways they performed in the simulation as well as ways to improve their performance (Rockstraw & Wilson, 2012). Benner (1984) states that the use of reflective practice enhances nurse’s critical thinking and decision making skills, which contributes to the advancement of the nurse’s scope of practice. The constructs of Benner’s model (skill advancement based on experience, critical thinking, and career progression), support the findings of this study, in which the positive trends of increasing HESI critical thinking sub-scores were not considered statistically significant, but showed improvement. Perhaps the time frame for simulation exposure as an adjunct to didactic and clinical experiences in this study were not ample enough to demonstrate a significant change in the students critical thinking.

The integration of simulation in the curriculum at the school of nursing in this study, requires students to participate in simulations for every course in the curriculum (Foundations, Communications, Mental Health Nursing, Pathophysiology I, Adult Medical-Surgical Nursing, Maternal-Newborn Nursing, Pharmacology, Child Health Nursing, Community Nursing, Leadership in Nursing, Critical Care Nursing, and Ethics), except Nursing Research and Pathophysiology II, which are linked to the didactic course objectives. With the exception of the medical-surgical nursing course, all required simulations are in addition to classroom and clinical hours, and consist of a two to three hour simulation session. The full day medical-surgical simulation lab substitutes one clinical day, with students participating in a scenario with a manikin and standardized patient, and includes a videotaped medication administration simulation.

All students (traditional and accelerated), were exposed to the same amount (approximately 35 hours) and type of scenario in their simulation experiences. The simulation
scenarios in this nursing program allow students to progress from practicing basic skills, such as taking vital signs and communicating with a patient, to more challenging and complex scenarios in subsequent semesters, such as administering a blood transfusion or taking care of multiple patients. These experiences provide the knowledge and skills necessary to apply to future simulations such as, gathering patient information, critically thinking, and making decisions about managing their patient’s care. The simulation program in this study uses the Simulation Evaluation Tool (Cicero & Mikasa, 2008), which is based on the AACN’s baccalaureate nursing competencies, to evaluate student learning after each simulation scenario (Appendix F). Student performance is leveled under each objective using Bloom’s Taxonomy. The use of this tool (which has established validity and reliability), has been beneficial in evaluating student learning in the simulation lab and correlates with the constructs of the HESI exit exam. Students also benefit from their traditional clinical experience which they bring to simulation. Unfortunately the experiences in the clinical setting such as clinical instructor, types of patients cared for, and ability to practice skills in the clinical setting, cannot be controlled.

Current research on the amount of time that can be substituted with simulation is ongoing and inconclusive. A recent study (Hayden et al., 2014), conducted by the National Council of State Boards of Nursing (NCSBN) used a large scale, randomized control design, to evaluate if some traditional clinical experience hours can be replaced with simulation. Findings from this longitudinal study revealed that there was no difference in clinical competency, nursing knowledge, and National Council Licensure Examination (NCLEX) pass rates between the groups that used simulation substitution. Additionally, this NCSBN study found that students in the group that substituted twenty-five percent of clinical time with simulation, significantly increased their critical thinking skills. These findings support Jeffries (2007) assertion that
learning, takes place over sequential simulation experiences. Statistically significant increases in scores over succeeding semesters support improvement in simulation performance with repeated experiences, especially with communication scenarios. Of note is that the NCSBN does not mandate a minimal amount of time for traditional clinical or simulation experiences, but instead requires that each school of nursing determine the right amount for their program, and provide a rationale for their decision (Hayden et al., 2014). Perhaps the substitution of ten, twenty-five, or fifty percent of traditional clinical experiences with simulation for each clinical course in the curriculum would enhance the development of critical thinking skills and produce statistically significant findings in HESI critical thinking sub-scores with the students in this study (Hayden et al, 2014).

**Limitations**

While the use of historical data in this study was convenient, it did present some limitations. As previously stated, I was unable to obtain HESI A2 admission scores for traditional students and pre-requisite GPA’s for accelerated students. This information was not computerized and I was unable to obtain it manually. Baseline cohort comparisons for homogeneity were done based on the minimal requirement to enter each program (which did not change during the study’s timeframe), with all students meeting the criteria for admission and progression in the program. Gender, age, and ethnicity, sample demographics were similar for the accelerated and traditional student cohorts. They were primarily female, and slightly more diverse than national percentages for baccalaureate nursing programs. The HESI exit examination scores are from a national databank of questions, so the questions in the 2011 exit examination may have been different (easier or more difficult) than the questions in the 2014 exit examination. Students in the 2014 cohorts may have had more exposure to technology than the
2011 cohort, based on increased use of technology during the study’s timeframe. Also of note, is the timing of when the HESI exams are scheduled. The students in both the 2011 and 2014 cohorts were required to take the HESI exit exam (on the same day), after taking a written final exam for the course, and may have suffered from exam fatigue, which might have affected their critical thinking scores. A surprising finding in this study, was the wide range of HESI critical thinking sub-scores. All students were exposed to the same course work and simulation scenarios, but the scores ranged from very low (scores in the 600’s) to very high (scores in the 1100’s) in both the traditional and accelerated students. This variability in scores produced a large standard deviation which affected the study’s findings, and prompted the following questions. Why do some students perform well on standardized exams and others do not? Is a HESI exit examination a good measure for student and program evaluation? Would a larger sample size have provided a statistically significant result? These questions may be answered with future studies focused on evaluation of instruments to measure critical thinking in nursing students. Missing students’ GPAs did not allow for correlational statistics with HESI test scores which may have added to an explanation of score differences between and within cohorts.

**Implications for Practice**

While this study’s statistically insignificant results did not support the hypothesis, the findings do add to the body of literature on simulation research and the development of critical thinking skills in undergraduate nursing students. Findings showed a positive trend after the implementation of simulation in an undergraduate nursing program, with an increase in HESI exit examination critical thinking sub-scores in all cohorts exposed to simulation. The complexity of our current healthcare environment requires nurses to have the critical thinking skills necessary in order to make clinical decisions that affect patient safety. Patients admitted to
acute care facilities are often sicker and are discharged quicker to home care settings. Assessment skills, development of patient goals and interventions, and evaluation of the plan of care depends on nurses’ critical thinking and clinical decision making skills. Nurse managers in practice settings concur that students who have had up to fifty percent of simulation substituted for traditional clinical experience, show no difference in demonstrated clinical skills, first time pass rates on NCLEX, and may have an increase in critical thinking, which will affect clinical decision making and patient safety (Hayden et al., 2014). The use of simulation in teaching nursing students provides a framework to build on previous experiences, which can be applied to situations in the clinical setting, as they move along the continuum from novice to expert nurses.

**Recommendations for Education**

Barriers to effective clinical education include lack of clinical sites, lack of experienced instructors, limits on what skills students can practice with patients in clinical settings, and lack of control over the type of patients in the clinical setting. Schools of nursing must be innovative in the education of nursing students with limited resources available. The use of simulation is one way that undergraduate nursing programs can provide and control for repeated practice of clinical situations for low incidence, highly critical events, in a safe learning environment. Schools of nursing have the freedom to allocate traditional clinical and simulation time as they see fit for their nursing program (Hayden, Smiley, & Gross, 2014). The increase in nursing programs using simulation as an adjunct or a substitution to traditional clinical experiences has been monumental during the last decade (Hayden et al., 2014). The investment of money and faculty training can be burdensome to some programs, but the benefits of preparing our students for a technology laden health care arena are necessary for their success as safe care givers.
Current research is providing evidence as to the right mix of substitution of simulation for traditional clinical experiences and can be used as a guideline in the development of curricular simulation implementation. The nursing program in this study will be increasing the amount of simulation starting with the fall 2017 semester and will substitute simulated experiences for approximately 25% of traditional clinical experiences for all clinical courses. This change in curriculum will enhance some of the traditional clinical experiences that were less than robust, and will strengthen the theory to practice link by bringing our clinical instructors into the simulation lab. This researcher plans to continue the investigation of the relationship of critical thinking skill development and simulation learning, with future cohorts of nursing students.

**Recommendations for Future Research**

Researchers have called for a moratorium on the development of new instruments to measure critical thinking and clinical decision making, instead suggesting longitudinal experimental studies, with large sample sizes and valid and reliable instruments, to evaluate if we are providing the education necessary to impact patient care and safety (Hayden et al., 2014). Further studies with larger sample sizes and multi-site studies, that correlate the use of the HESI exit examination, simulation evaluation, and critical thinking scores, are needed to examine the impact of simulation implementation and development of critical thinking in nursing students. Replication of this study would add valuable information to current nursing research. In addition, adding a qualitative piece to studies can add insight into students thought processes during simulation, which may provide more robust findings. Further studies are needed to examine outcomes of critical thinking when substituting traditional clinical hours with simulation. Also needed are studies to help determine the right mix of traditional clinical hours and simulation hours to provide evidence for curricular improvements in nursing education.
Additionally, studies are needed that evaluate simulation outcomes (critical thinking skill development) and the transition from education to clinical practice.

**Conclusion**

Previous studies have focused on student satisfaction, self-confidence, and self-efficacy, but no other study has evaluated the relationship of simulation and the development of critical thinking skills as measured by the HESI exit examination critical thinking sub-scores. While this study did not provide statistically significant findings to support the relationship, it did show a positive trend of increased HESI exit examination critical thinking sub-scores for all cohorts after the implementation of simulation. The findings of this study are consistent with previous research, which are equivocal in assessing the measurement of knowledge gained through the use of this teaching strategy. Educating nurses to be knowledgeable, competent, practitioners is challenging. More studies are needed to assess the transfer of learning in a simulated environment and its effect on patient care.
### Table 1

**Search Terms.**

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<th>Undergraduate Nursing Students</th>
<th>Simulation</th>
<th>Learning</th>
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<td>Associate degree programs,</td>
<td>Differences in fidelity of simulations, standardized patients, multiple</td>
<td>Knowledge gains, transfer of skills, student satisfaction, clinical</td>
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<td>diploma programs,</td>
<td>simulations, comparison with another teaching strategy, debriefing</td>
<td>reasoning, critical thinking, patient safety, active learning</td>
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<td>baccalaureate programs,</td>
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<tr>
<td>nursing students, nursing</td>
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<td>education</td>
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### Table 2

**Terms used in literature to describe learning.**

| Education, knowledge, acquired knowledge, acquisition of knowledge, acquisition of skills, clinical knowledge, clinical skills, transfer of learning, retention | Critical thinking, critical decision making, clinical judgement, clinical reasoning, clinical performance, clinical competence | Conceptualizing, applying, analyzing, synthesizing, evaluating information, problem solving, debriefing, reflection |
Figure 1 Search strategy flow chart.

Records identified through database searching (n = 214)

Additional records identified through other sources (n = 2)

Records after duplicates removed (n = 94)

Records screened (n = 67)

Full-text articles assessed for eligibility (n = 42)

Records excluded (n = 25)

Full-text articles excluded, with reasons (n = 22)
Simulation studies from other disciplines
Studies with licensed nurses
Computer or virtual simulation
Student perceptions about simulation

Studies included in qualitative synthesis (n = 2)

Studies included in quantitative synthesis (meta-analysis) (n = 18)
Table 3

Critical appraisal of literature, quantitative.

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<td>2 Hypothesis/research questions clearly specified</td>
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<td>5 Design adequately described</td>
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<td>6 Method appropriate</td>
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<td>7 Instruments used tested for reliability and validity</td>
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<td>15 Limitations reported</td>
<td>22</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>16 Conclusions do not go beyond limit of data and results</td>
<td>22</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>17 Findings able to be generalized</td>
<td>11</td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>18 Implications discussed</td>
<td>22</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>19 Existing conflict of interest with sponsor</td>
<td>4</td>
<td></td>
<td>18</td>
</tr>
<tr>
<td>20 Data available for scrutiny and reanalysis</td>
<td>21</td>
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</table>
Table 4  
Critical appraisal of literature, qualitative.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Qualitative studies critical appraisal checklist</th>
<th>Kaplan, 2010</th>
<th>Hart, 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Congruity between stated philosophical perspective and research methodology</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2. Congruity between methodology and research question or objectives</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3. Congruity between methodology and methods used to collect data</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4. Congruity between methodology and representation and analysis of data</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>5. Congruity between methodology and interpretation of results</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>6. There is a statement locating the researcher culturally or theoretically</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. The influence of the researcher on the research, and vice-versa is addressed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Participants and their voices are adequately represented</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>9. Ethical according to current criteria, evidence of ethical approval</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>10. Conclusions drawn flow from analysis or interpretation of data</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
Table 5
Three major themes identified in the literature.

<table>
<thead>
<tr>
<th>Critical thinking</th>
<th>Application to practice</th>
<th>Self-confidence and competence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge gains and retention, clinical reasoning, decision making, debriefing, critical thinking, link to learning objectives</td>
<td>Clinical performance, competency, patient safety, transfer of skills to clinical practice, holistic care</td>
<td>Student satisfaction, valuable learning experience, decreased anxiety, increased retention with performance, confidence</td>
</tr>
<tr>
<td>Author</td>
<td>Study</td>
<td>Method</td>
</tr>
<tr>
<td>--------</td>
<td>----------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Burns et al., 2010 US</td>
<td>High-fidelity Simulation in Teaching Problem Solving to 1st Year Nursing Students, A Novel Use of the Nursing Process</td>
<td>Prospective design Faculty developed tool</td>
</tr>
<tr>
<td>Guhde, 2011 US</td>
<td>Nursing Students’ Perceptions of the Effect on Critical Thinking, Assessment, and Learner Satisfaction in Simple Versus Complex High-Fidelity Scenarios</td>
<td>Survey design based on NLN nursing education simulation framework, developed by researcher</td>
</tr>
<tr>
<td>Hart et al., 2014 US</td>
<td>Effectiveness of a Structured Curriculum Focused on Recognition and Response to Acute patient Deterioration in an Undergraduate BSN Program</td>
<td>Mixed method – quasi experimental repeated measures and descriptive qualitative approach, researcher developed questionnaire</td>
</tr>
<tr>
<td>Howard et al., 2010 US</td>
<td>Human Patient Simulators and Interactive Case Studies: A comparative analysis of learning outcomes and student perceptions</td>
<td>Quantitative quasi-experimental pre-test/post-test design comparing two teaching strategies HESI custom exams</td>
</tr>
<tr>
<td>Jeffries and Rizzolo, 2006 US</td>
<td>Developing and Implementing Models for the Innovative Use of Simulation to Teach Nursing Care of Ill Adults and Children: A National, Multi-Site, Multi-Method Study</td>
<td>National multi-site, multi-method design to develop a simulation framework</td>
</tr>
<tr>
<td>Miller et al., 2010 US</td>
<td>Utilizing Human Patient Simulators (HPS) to Meet Learning Objectives Across Concurrent Core Nursing Courses: A Pilot Study</td>
<td>Descriptive design Tool with established V+R</td>
</tr>
<tr>
<td>Nicholson, 2010 US</td>
<td>Comparison of selected outcomes based on teaching strategies that promote active learning in nursing education</td>
<td>Experimental post-test only design, researcher developed questionnaire</td>
</tr>
<tr>
<td>Author</td>
<td>Study</td>
<td>Method</td>
</tr>
<tr>
<td>---------------------</td>
<td>-----------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Schinnick et al., 2012 US</td>
<td>Predictors of Knowledge Gains Using Simulation in the Education of Prelicensure Nursing Students</td>
<td>2 group repeated measures experimental design, CCTDI tool, established V+R</td>
</tr>
<tr>
<td>Schlariet and Pollock, 2009 US</td>
<td>Equivalence Testing of Traditional and Simulated Clinical Experiences: Undergraduate Nursing Students’ Knowledge Acquisition</td>
<td>2 X 2 crossover design with equivalence testing, researcher developed knowledge test based on NCLEX questions</td>
</tr>
<tr>
<td>Shepherd et al., 2010 UK</td>
<td>Investigating the use of simulation as a teaching strategy</td>
<td>Longitudinal comparative quasi-experimental design, tool with established V+R</td>
</tr>
<tr>
<td>Swanson et al., 2011 US</td>
<td>Comparison of Selected Teaching Strategies Incorporating Simulation and Student Outcomes</td>
<td>Experimental post-test design, researcher developed student performance rubric</td>
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<tr>
<td>Application to practice, N=7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bambini et al., 2009 US</td>
<td>Outcomes of Clinical Simulation for Novice Nursing Students: Communication, Confidence, Clinical Judgment</td>
<td>Integrated quasi-experimental repeated measures design, faculty developed tool, established V+R</td>
</tr>
<tr>
<td>DeBourgh and Prion, 2011 US</td>
<td>Using Simulation to Teach Prelicensure Nursing Students to Minimize patient Risk and Harm</td>
<td>Quasi-experimental pre/post-test design, researcher developed tool, student self-report</td>
</tr>
<tr>
<td>Ironside et al., 2009 US</td>
<td>Fostering patient-safety competencies using multiple-patient simulation experiences</td>
<td>Exploratory design based on NLN Nursing education simulation framework, MSTAT tool, established V+R</td>
</tr>
<tr>
<td>Author</td>
<td>Study</td>
<td>Method</td>
</tr>
<tr>
<td>------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>Kameg et al., 2010 US</td>
<td>The Impact of High Fidelity Human Simulation (HFHS) on Self-Efficacy of Communication Skills</td>
<td>Quasi-experimental</td>
</tr>
<tr>
<td>Kaplan and Ura, 2010 US</td>
<td>Use of Multiple patient Simulators to Enhance Prioritizing and Delegating Skills for Senior Nursing Students</td>
<td>Researcher developed questionnaire</td>
</tr>
<tr>
<td>Kirkman, 2013 US</td>
<td>High fidelity Simulation Effectiveness in Nursing Students’ Transfer of Learning</td>
<td>Time series design, OSCE evaluation, established V+R</td>
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<tr>
<td>McCaughey and Traynor, 2010 UK</td>
<td>The role of simulation in nurse education</td>
<td>Descriptive longitudinal design, faculty developed tool</td>
</tr>
<tr>
<td>Self-confidence and competence, N=2</td>
<td></td>
<td>Quasi-experimental, Lasater Clinical Judgement Rubric</td>
</tr>
<tr>
<td>Blum et al., 2010 US</td>
<td>High-Fidelity Nursing Simulation: Impact on Student Self-Confidence and Clinical Competence</td>
<td>Quasi-experimental, Lasater Clinical Judgement Rubric</td>
</tr>
<tr>
<td>Liaw et al., 2011 Singapore</td>
<td>Assessment for simulation learning outcomes: A comparison of knowledge and self-reported confidence with observed clinical performance</td>
<td>Prospective pre/post-test design, Rapids tool, established V+R, plus researcher developed questionnaire</td>
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</table>
Figure 2: Researchers interpretation of the relationship between Benner’s model, simulation learning, the HESI and NCLEX exams, and critical thinking.
Table 7: Counts and Percentages for Demographics by Student Type

<table>
<thead>
<tr>
<th>Variable</th>
<th>Accelerated</th>
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<th>Traditional</th>
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<th>Total</th>
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<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
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<td>Gender</td>
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<tr>
<td>Female</td>
<td>79</td>
<td>38.7</td>
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<td>50.5</td>
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<td>5.4</td>
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<td>Race/Ethnicity</td>
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<td>Asian - Indian Subcontinent</td>
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<td>0.87</td>
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<td>1</td>
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<td>3.37</td>
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<td>3.48</td>
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<td>Black - Caribbean/West Indian</td>
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<td>1.12</td>
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<td>1</td>
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<td>2.25</td>
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<td>1.74</td>
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<td>2</td>
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<tr>
<td>Other Asian or Far Easterner</td>
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<td>2.25</td>
<td>4</td>
<td>3.48</td>
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<td>2.9</td>
</tr>
<tr>
<td>Other Black</td>
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<td>4.49</td>
<td>11</td>
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<td>Other Tribal Affiliations</td>
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<td>1</td>
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<td>Unreported</td>
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<tr>
<td>White - American</td>
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<td>17.98</td>
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<td>7.83</td>
<td>25</td>
<td>12.3</td>
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<tr>
<td>White - European</td>
<td>7</td>
<td>7.87</td>
<td>9</td>
<td>7.83</td>
<td>16</td>
<td>7.8</td>
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</table>
Figure 3: Critical thinking scores by simulation
Table 8: Means and Standard Deviations for Critical Thinking by Simulation

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
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<tbody>
<tr>
<td>Simulation</td>
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<tr>
<td>No Simulation</td>
<td>841.64</td>
<td>121.74</td>
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</table>
Figure 4: Critical thinking scores by student type
Table 9: Means and Standard Deviations for Critical Thinking by Traditional and Accelerated Students

<table>
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<th></th>
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<th>SD</th>
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<tr>
<td>Traditional</td>
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<td>115</td>
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<tr>
<td>Accelerated</td>
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<td>101.23</td>
<td>103</td>
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</table>
Table 10: Means and Standard Deviations for Critical Thinking by Simulation and Student Type

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
<th>n</th>
<th>95% Confidence Interval</th>
</tr>
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<tbody>
<tr>
<td><strong>Traditional Student</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simulation</td>
<td>860.60</td>
<td>94.11</td>
<td>53</td>
<td>834.66-886.54</td>
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<tr>
<td>No Simulation</td>
<td>828.58</td>
<td>135.50</td>
<td>62</td>
<td>794.17-862.99</td>
</tr>
<tr>
<td><strong>Accelerated Student</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simulation</td>
<td>872.81</td>
<td>104.27</td>
<td>59</td>
<td>845.64-899.99</td>
</tr>
<tr>
<td>No Simulation</td>
<td>860.05</td>
<td>97.72</td>
<td>44</td>
<td>830.34-889.75</td>
</tr>
</tbody>
</table>
Table 11: 2x2 Between Subjects ANOVA for Student Type and Simulation on Critical Thinking Scores

<table>
<thead>
<tr>
<th></th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p value</th>
<th>Partial Eta Squared</th>
<th>Observed Power</th>
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<tr>
<td>Error</td>
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</table>
Appendix A. Quantitative studies critical appraisal checklist (Bowling, 2009)

|-----------------|-----------------------|-----------------------|---------------------|-------------------|-----------|-----------------------|---------------------|---------------------|---------|-----------|-----------|-------------------|-----------------|-----------------|-----------------|----------------|----------------|-------------|_____________|
| 1 Bambini et al., 2009 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | 18 |
| 2 Blum et al., 2010 | X | X | X | X | X | X | X | X | X | X | X | X | X | 16 |
| 3 Batts et al., 2010 | X | X | X | X | X | X | X | X | X | X | X | X | X | 16 |
| 4 DeBourgh and Prion, 2011 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | 15 |
| 5 Gahide, 2011 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | 15 |
| 6 Howard et al., 2010 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | 17 |
| 7 Jessade et al., 2009 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | 17 |
| 8 Jeffries and Rizolo, 2006 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | 17 |
| 9 Kameg et al., 2010 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | 14 |
| 10 Kirkman, 2013 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | 15 |
| 11 Law et al., 2011 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | 15 |
| 12 McCaffer and Traynor, 2010 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | 14 |
| 13 Miller et al., 2010 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | 14 |
| 14 Nicholson, 2010 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | 18 |
| 15 Schlarat and Pollock, 2009 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | 16 |
| 16 Shepherd et al., 2010 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | 15 |
| 17 Shinnick et al., 2011 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | 16 |
Appendix B: Pediatric Simulation Scenario

Pre-Sim Assignment: Pediatrics-Asthma

Learning Outcomes of Simulation: At the end of this simulation session, the students will:

1. Conduct a focused assessment of a child admitted with difficulty breathing.
2. Demonstrate appropriate management of a child with severe exacerbation of asthma, including prioritization of nursing interventions, and implementation of nursing actions.
3. Communicate effectively with all participants in this child’s care, including family members and other health care professionals.
4. Interpret appropriate diagnostic tests associated with asthma.

PRIOR TO SIMULATION PLEASE COMPLETE THE FOLLOWING ACTIVITIES:

Review patient chart and create new nursing care plan

1. Log onto EHR tutor at www.Ehrtutor.com with your username and password
2. Under courses, select NYC ABSN Spring2016 in left hand column
3. Choose Pre Sim patient Chart Review Peds, Choose patient Jesse Klein
4. Click on New Nursing Diagnosis and fill in appropriate text boxes. Boxes will expand to accommodate additional text.
5. Please include 1 -2 Nursing diagnoses in your care plan.
6. Press Save to submit your changes

Please answer all questions in complete sentences and hand in to your simulation instructor:

1. What are common manifestations of an acute asthma attack in children?
2. What factors may trigger asthma in children?
3. List three medications used as quick relief medications in asthma exacerbation and three medications used for long term control?
4. Describe the use of a peak flow meter in the care of a child with asthma

Make a separate card for each medication:

- Albuterol nebulizer solution 2.5mg
- Methylprednisolone IV
- Ipratropium inhaled 0.5 mg
- Flovent (fluticasone propionate)
- Singulair (Montelukast)
Skills to Review:

Medication delivery via nebulizer, instructing patient/family on the use of metered Dose Inhaler (MDI) with spacer, Peak Flow Meter. Focused respiratory assessment, hanging a Piggy Back.

Required Reading

The Asthma Action Plan  (Ctrl + click to open the link)

Nurses: Partners in Asthma care (click the link below)

Asthma Pediatric Patient Faculty Version

Name: Jessie Klein
DOB: 08/07
MR#: 987287
Age: 6
Weight: 44lbs. Height: 41in.
Healthcare Provider: Jackson, Marjorie MD
Admission Date: today
Manikin: SimJunior
Participant Roles: Parent

Overview:
This six-year-old patient comes to the Emergency Department with an acute exacerbation of asthma, is treated, improves and is discharged to home. The scenario ends with the child being discharged to home 18 hours after treatment with nebulizers, IV hydration and steroids.

Brief Summary:
State One: Mom and child in ED acute asthma exacerbation, students are expected to assess and administer albuterol and steroids; Patient has minimal improvement and notifies HCP.
State Two: Nurses expected to administer additional nebulized meds, increased oxygen therapy and discourage mom from leaving to smoke. Patient shows clinical improvement.
State Three: 18 hours later the child has improved and is ready for discharge. The students should provide discharge teaching including trigger avoidance and community support (school nurse).

Learning Outcomes:
At the end of this simulation session, the students will:

1. Conduct a focused assessment of a child admitted with difficulty breathing.

2. Demonstrate appropriate management of a child with severe exacerbation of asthma, including prioritization of nursing interventions, and implementation of nursing actions.

3. Communicate effectively with all participants in this child’s care, including family members and other health care professionals.

4. Interpret appropriate diagnostic tests associated with asthma.
# State 1 Admission to ED

<table>
<thead>
<tr>
<th>Vital signs:</th>
<th>HR=112; BP=106/84; RR=32; SpO$_2$=89%; Temp=37.6°C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>When albuterol is given trend to the following over 5 minutes: BP=110/72; RR=26; HR=122, SpO$_2$= 92%</td>
</tr>
<tr>
<td>Assessment:</td>
<td>Cardiac Rhythm=Sinus Tachycardia; Breath Sounds=Wheezes bilaterally in all lung fields **Pt is using accessory muscles to breath and there are auditory inspiratory and expiratory wheezes. Eyes are glassy. Skin is warm, moist and pale.</td>
</tr>
<tr>
<td>Patient responses:</td>
<td>Decreased verbalization. Patient is sitting straight up on stretcher with tears in her eyes. Cough with ice chips</td>
</tr>
<tr>
<td>Diagnostic Test results:</td>
<td>Peak flow reading is in the red (83 mL/min) prior to albuterol, peak flow after albuterol 92 mL/min) IF ABG is obtained in STATE ONE: pH 7.44, PaO2 62 mmHg, PaCo2 33 mmHg, HCO3 22 mmol/L, O2 saturation 88%.</td>
</tr>
</tbody>
</table>

**Prescription/Orders for State One (available at start of simulation)**

- Admit to pediatric when bed available
- Continuous ECG and O$_2$ Sat monitoring
- Albuterol 2.5 mg via nebulizer STAT
- IV 500 ml 0.9% NACL run at 30 ml/hr
- Methylprednisolone (1mg/kg) 20mg IVPB one dose STAT, infuse in 30 min. then 10mg IVPB Q6hours
- Oxygen via nasal cannula 2LPM
- If O$_2$ Sat is less than 95%
  - Notify MD/ NP
  - Obtain ABG
- NPO except for ice chips

**Expected Student Interventions for State 1:**

- **Assessment:**
  - Obtains vital signs
  - Performs a focused respiratory assessment
  - Identifies respiratory distress
  - Evaluates peak flow readings
  - Evaluates oxygenation status
• **Nursing Interventions:**
  - Applies oxygen and adjusts flow per nasal cannula
  - Obtains peak flow reading
  - Administers medications following the Six Rights

• **Communication:**
  - Notifies healthcare provider of assessment findings.
  - Provides age-appropriate communication and reassurance to patient
  - Provides reassurance to parent

State one ends with minimal improvement after student notify health care provider of respiratory status and second set of orders are delivered.
State 2 Minimal Improvement after first albuterol and oxygen by NC

<table>
<thead>
<tr>
<th>Vital signs:</th>
<th>BP=110/72; RR=26; HR: 122; SpO₂=92%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>When non-rebreather mask is applied trend vital signs to the following over 3 minutes RR: 24; HR 112; SpO₂=98%</td>
</tr>
<tr>
<td>Assessment:</td>
<td>Neuro: alert but fatigued.</td>
</tr>
<tr>
<td></td>
<td>Respiratory: Breath Sounds- decreased wheezing</td>
</tr>
<tr>
<td></td>
<td>G: Bowel Sounds=Hyperactive</td>
</tr>
<tr>
<td></td>
<td>GU: No urinary output.</td>
</tr>
<tr>
<td></td>
<td>Skin: Lips and mucous membranes dry; capillary refill 2 seconds</td>
</tr>
<tr>
<td></td>
<td><strong>Peak flow is in yellow zone- 90 L/min</strong></td>
</tr>
<tr>
<td>Patient responses:</td>
<td>The patient is awake but sleepy; communicating in 1-2 word sentences</td>
</tr>
<tr>
<td>Diagnostic Test results:</td>
<td><strong>ABG:</strong> pH 7.34, PaO₂ 72 mmHg, PaCo₂ 44 mmHg, HCO₃ 22 mmol/L, O₂ saturation 90%.</td>
</tr>
</tbody>
</table>

Parent asks to leave child to go outside and smoke.

**Prescription / Orders for State Two**

- Albuterol 2.5 mg mixed with ipratropium 0.5 mg via nebulizer STAT
- Administer oxygen by non-rebreather mask for O₂ Sat less than 95%
- Begin IV 0.9% Normal Saline @ 42ml/hour

**Expected Student Interventions for State 2:**

- **Assessment:**
  - Obtains vital signs
  - Repeats assessment
  - Identifies improved condition
  - Allows child to remain in position of comfort

- **Nursing Interventions:**
  - Begins IV infusion via IV pump and following the Six Rights
  - Frequently monitors patient status
  - Administers medication following the Six Rights
  - Interprets pulse ox
  - Applies Non-rebreather mask

- **Communication:**
  - Provides age-appropriate communication and reassurance to patient
  - Notifies healthcare provider of condition
  - Discourages parent from leaving child’s bedside to smoke

End of State Two: significant improvement after administration of nebulized meds and non-rebreather mask.
State 3 Improvement and Discharge 18 hours later

<table>
<thead>
<tr>
<th>Vital signs:</th>
<th>HR=100; BP=100/66; RR=22; SpO2=98% on room air; Temp=37°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment:</td>
<td>Breath Sounds=Clear, no intercostals or substernal retractions</td>
</tr>
<tr>
<td></td>
<td>Bowel Sounds= hyperactive</td>
</tr>
<tr>
<td></td>
<td>Skin warm, dry, pink</td>
</tr>
<tr>
<td>Patient responses:</td>
<td>Very talkative, states she wants to go home and play with her kitten</td>
</tr>
<tr>
<td>Diagnostic test results:</td>
<td>Peak flow reading is 88% (152 L/min).</td>
</tr>
</tbody>
</table>

Prescription / Orders for State Three

- Discharge to home with parent if Peak flow is greater than 80%
- Discharge medications
  - Flovent 110mcg 2 puffs with spacer BID
  - Singular 5 mg PO daily @bedtime
  - Albuterol MDI Q 4 hours with spacer 2 puffs PRN for wheezing or shortness of breath, as described on Action Plan
  - Atrovent with spacer 2 puffs PRN for wheezing or shortness of breath, as described on Action Plan
  - Prednisone 20mg orally X one dose PRN as described in Action Plan

Expected Student Interventions State 3:

- **Assessment:**
  - Repeat respiratory assessment
  - Reassess peak flow

- **Nursing Interventions:**
  - Interprets peak flow findings
  - Provides discharge teaching to mother that includes: increase fluid intake, signs and symptoms to prompt return to Emergency Department, use of peak flow meter, discharge meds, action plan, and community support.

- **Communication:**
  - Notify HCP of patient status
  - Provides information to mother about treatment plan
  - Communicates appropriately with six-year-old patient
SBAR Handoff Report

Situation:
This six-year-old child has been brought to the Emergency Department by a parent for difficulty breathing. The parent reports the child has asthma and has been experiencing increasing shortness of breath for the past two days. The baseline peak flow is 173 and recent peak flow readings have been in the 50-80% range. The parent has increased nebulizer treatments, but the child is still wheezing. Parent is at the bedside and cigarette smoke can be smelled on the parent’s clothing. The HCP has examined the child and orders have been written.

Background:
Patient History
Past Medical History: Born prematurely at 32 weeks. Asthma for the past 3 years. Up to date with all his immunizations (per parent).
Allergies: No known drug allergies
Medications: The child currently uses albuterol aerosol for relief of acute symptoms and Flovent MDI at home.
Language: English
Code Status: Full Code
Social History: Child lives at home with parent. Child is currently in the first grade.

Assessment:
Vital signs: HR 112, B/P 106/70, RR 28, Temp 37°C, Os sat 92% on 2 liters
General Appearance: slightly agitated, breathless after walking around room
Cardiovascular: Normal sinus rhythm
Respiratory: wheezing bilaterally
GI: hyperactive bowel sounds
GU: urinated 1 hour ago in bedpan, 150mL clear yellow urine
Extremities: warm to touch
Skin: Warm, dry, pale
Neurological: Alert and oriented to person, place and time, quiet
IVs: saline lock right arm
Labs: drawn but results pending
Fall Risk: Low-risk
Pain: denies pain

Recommendations: Initiate healthcare provider orders and monitor respiratory status.
Questions to be asked during debriefing:
1. How are you feeling about the simulation?
2. What do you think went well during the scenario?
3. What would you change or do differently?
4. What do you plan to incorporate into your practice next time?
5. How did you decide on your priorities for care and what would you change?
6. How did patient safety concerns influence your care? What did you overlook?
7. In what ways did you personalize your care for this patient and family members (recognition of culture, concerns, anxiety)?
8. Discuss your teamwork. How did you communicate and collaborate? What worked, what didn't work and what will you do differently next time?
9. What are you going to take away from this experience?

Additional Questions and Answers
1. What is the nurse’s first priority in caring for this patient?
   - Respiratory and general assessment
2. What risk factors predispose this patient to an exacerbation of asthma?
   - History of reactive airway disease as infant and prematurity
3. Why might her nebulizer treatments not have helped?
   - The nebulizer treatment used albuterol, which is a rescue (quick relief) medication
   - To treat acute symptoms, a combination of the quick relief medication (bronchodilator) and an anti-inflammatory (long-term) is needed.
4. What assessment findings would indicate improvement in her condition?
   - Increase in oxygen saturation greater than 95%, • Peak expiratory flow rate between 80-100%, • Decrease in wheezing, • Increase HR, • Decreased RR
5. What information will be obtained by assessing the child’s peak flow?
   - Early changes in the disease status that require treatment
   - Evaluation of response to treatment
   - Assessment of severity of airflow obstruction
   - Provide quantitative measure of impairment
6. What are the untoward effects of albuterol to monitor for?
   - Palpitations, • Bradycardia, • Tachycardia, • Anxiety, • Nervousness, • Restlessness
   - Convulsions, • Headache, • Hypertension
7. How does albuterol affect the respiratory system?
   - Produces bronchodilation by relaxing smooth muscles of bronchial tree
   - Decreases airway resistance
   - Facilitates mucus drainage
8. What assessment findings indicate improvement in the child’s condition?
   - Peak flow rate in the middle range of the green area
   - Oxygen saturation at 99%
   - HR increased
   - RR decreased
9. What is the rationale for prednisolone administration?
   - Provide a systemic intermediate acting anti-inflammatory effect in combination with the Bronchodilator
   - Best practice protocol for acute treatment
10. What should the nurse teach the mother about giving corticosteroids?
• Administer with meals to reduce gastrointestinal irritation
• Adhere to prescribed dosage regimen
• Do not omit, increase or decrease dose

11. What discharge teaching should be provided to the mother?
• When to seek medical help
• How to use the peak flow meter
• Medication regimen
• Avoidance of triggers

What are the priority interventions for this patient?
• Place stretcher in high Fowler’s position
• Attach to cardiac monitor with pulse oxymeter
• Respiratory assessment
• Notify healthcare provider

12. What assessment findings indicate the severity of her condition?
• Elevated HR, RR, BP
• Unable to speak
• Sitting position
• Wheezing
• Using accessory muscles to breathe
• Nasal flaring
• Peak flow less than 50% (red zone)

13. Why is the child unable to speak?
• Airway occlusion and all energy is on breathing
• Cannot talk and breathe at the same time

14. Should the child be encouraged to lie back on the stretcher?*No

15. Why or why not?
• This position allows for maximal ventilatory effort and lung expansion

16. What are the implications of the pulse oximetry and peak flow reading?
• Poor tissue perfusion and gas exchange
• Severe respiratory impairment

How does the nurse determine how much oxygen to apply and what device to use?
• Oxygen administration is based on maintaining oxygen saturation above 90%
• Administration devices are based on the ability of the device to deliver the amount of oxygen ordered
• The non-rebreather mask can deliver high concentrations of oxygen and predictable concentrations of oxygen whether the child breathes through nose or mouth

17. What are accessory muscles, and why are they being used to aid the child’s breathing?
• Muscles that provide support for normal muscles used in breathing
• Used because of increased airway resistance that leads to increased work of breathing

18. Why is this child drowsy?
• Hypoxia is severe and affecting mental status

19. Why has the healthcare provider ordered IV fluids?
• Provide hydration that will thin secretions and maintain adequate fluid balance

20. What is the rationale for adding ipratropium to the nebulizer treatments?
• Using ipratropium with another bronchodilator may potentiate action

21. Why has the steroid been changed to the intravenous route?
• Condition precludes continued oral fluids or medications
• May have faster onset of action than oral route

22. What complications can arise when IV medications are injected too quickly?
• Plasma levels increase to toxic level quickly leading to speed shock
• Headache, Syncope, Flushed face, Chest tightness, Irregular pulse, Shock, Cardiac arrest
Pace Hospital
PEDIATRIC DISCHARGE ORDERS

Name: Jessie Klein
DOB: 8/07
MR: 987287
Admitting MD: Jackson, R.
Admission date: today

DISCHARGE SUMMARY:
Jessie Klein presented to ED with exacerbation of asthma. Upon initial evaluation Jessie Klein has wheezing and oxygen saturation of 92% on room air. Pt was given albuterol nebulizer treatments, steroids and IV hydration which provided relief. Jessie Klein is being discharged home in stable condition with parent. Please see Action Plan and discharge instructions below.

Follow Up Care:
Please call for follow up appointment with Dr. Jackson for one week from today

Diet: Regular and encourage fluids.

Activities: No restrictions

Control of Environment: Provided counseling regarding smoking cessation (parent) and indoor pets.

Additional Instructions: Call your doctor if you have shortness of breath, or quick relief medications have not helped, or your symptoms are the same or get worse after 24 hours. If you have severe symptoms report to hospital or call for an ambulance. Peak flow readings in the morning and at bedtime. Follow asthma Action Plan.

MEDICATION ORDERS FOR DISCHARGE: SEE ASTHMA ACTION PLAN

"I have read and understand the above instructions."

"Parent/Guardian:

____________________________________________________________________

Nurse:
_____________________________________________________________________________

Date: ________________

Physician Signature _________________________________________________________

Date ______________

Time ____________
Faculty Observation Sheet

Scenario: Pediatric Asthma

<table>
<thead>
<tr>
<th>Date: __________________</th>
<th>Faculty: ______________</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>Positive Findings</td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Switch Time</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
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<tr>
<td>Switch Time</td>
<td></td>
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<tr>
<td>3</td>
<td></td>
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<tr>
<td>Switch Time</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Switch Time</td>
<td></td>
</tr>
</tbody>
</table>

Learning Outcomes: at the end of the scenario, the student will be able to:

<table>
<thead>
<tr>
<th>Met</th>
<th>Unmet</th>
</tr>
</thead>
</table>

1. Conduct a focused assessment of a child admitted with difficulty breathing.

2. Demonstrate appropriate management of a child with severe exacerbation of asthma, including prioritization of nursing interventions, and implementation of nursing actions.

3. Communicate effectively with all participants in this child’s care, including family members and other health care professionals.

4. Interpret diagnostic tests associated with asthma.
Standardized Patient Participant

Patient: Jessie Klein 6 year old (manikin)  Participant: SP

Length of Simulation: 40 minutes

Setting: Emergency dept.

Standardized Patient (SP) Opening Line: Is my child going to be okay?

Position of SP: Sitting at bedside, hand on bed or child’s foot/hand

Body Language: Concerned parent, anxious (becomes more anxious if student does not start nebulizer treatment in a short period of time).

SP Clothing: Comfortable casual/street clothing (e.g. jeans, clean sweat pants, sneakers)

Communication: Responsive/forthcoming/no hidden agenda

Challenge Questions

Q: How can you help my child, does he/she need oxygen – his/her breathing is so bad?
A: There are medications that will help relieve the bronchospasm or open the airway and make it easier for your son to breath.

Q: Why did this happen? What’s a trigger?
A: There are many things that can trigger an asthma attack including respiratory tract infections, exposure to mold, cockroach droppings, pollen, cold air and even exercise. Perhaps triggers can be identified to help reduce the number of asthma attacks, but asthma is a chronic illness.

Q: What is the light on his/her finger?
A: It is called an Oxygen Saturation Monitor, and it measures how well your son is breathing and getting oxygen into his blood where it belongs.
**Script**

**Student:** How long has your son been feeling ill?

**SP:** _He started feeling bad during the night, he was wheezing a lot._

**Student:** Does your child take any medications?

**SP:** _Flovent 2 puffs twice a day and albuterol when he get wheezy, last albuterol was 2 hours ago (if asked NO spacer used)_

**Student:** Do you monitor your child’s peak flow?

**SP:** _Yes his best is 173_

**Student:** Does your child have a history of allergies?

**SP:** _no allergies_

**Student:** Does your son have any known triggers?

**SP:** _What’s a trigger?_

**Student:** Respiratory tract infections, exposure to mold, cockroach droppings, pollen, cold air, exercise, and cigarette smoke.

**Student:** Do you or anyone else smoke in the house?

**SP:** _Yes, I sometimes smoke at night after he goes to bed._

**Student:** When was the last time your child had wheezing (asthma attack)?

**SP:** _About 2 months ago._

**Student:** Do you see a pulmonologist or a pediatrician regularly?

**SP:** _I take him to the pediatrician at least every 6 months, but I haven’t seen a pulmonologist._

_What is that? (A pulmonologist is a lung specialist)._  

**Student:** Has anything helped your son in the past?

**SP:** _Well, the inhaler usually helps (Albuterol if asked)._
## CHILD HEALTH NURSING

### Scenario: Pediatric Asthma

<table>
<thead>
<tr>
<th>SP Check-List</th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduces self &amp; role/title</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good eye contact</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Professional manners (e.g. provided privacy, collegial practice)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Speaks in understandable terms</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Was an active listener (e.g. let you finish speaking, responded appropriately)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Washes hands before touching my child</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explained to me what was being done to my child</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explained purpose of medical monitors and peak flow meter</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explained “asthma” and any medications administered</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discussed the dangers of cigarette smoking and other asthma triggers</td>
<td></td>
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</tr>
<tr>
<td>Made to feel comfortable/reassured</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student was rushed &amp; disorganized</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Invited me to ask questions or express concerns?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student(s) seem competent/confident</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Door Sign 1
Jessie Klein is a 6 year old with a history of asthma for 3 years. He was in good health until two days ago. Jessie has had increasing shortness of breath and coughing unrelieved by albuterol. The patient’s mother is at the bedside and slightly anxious.

You are caring for Jessie in the Emergency Department and should provide an assessment and the necessary interventions.

Door Sign 2
Jessie has minimal improvement following albuterol and is receiving oxygen. Assess status of patient and follow new orders as per HCP. Devise a plan of care based on your nursing assessment.

Door Sign 3
Jessie has improved significantly and is being discharged to home. Review with Jessie and Mom the Asthma Action Plan.

When doing discharge teaching, remember that Jessie will be returning to school.
Appendix C. Elsevier research agreement

Agreement to participate in Elsevier/HESI Educational Research Projects

Thank you for agreeing to participate in Elsevier/HESI-focused research to meet requirements for your study. Please review the Elsevier/HESI guidelines that pertain to educationally-focused research studies, and sign and return a copy of this form to us prior to handling any Elsevier/HESI data.

(1) All data received for analysis must be maintained in a secure location for the duration of the faculty involvement with this study.
(2) The faculty member agrees to maintain the confidentiality of all individual scores identified within any data summary document.
(3) The faculty member recognizes that reporting of Elsevier/HESI-focused research findings are described as aggregate findings only, which is a criterion of educational studies exempt from review of the institutional review boards (IRB) as recognized by the IRBs at most universities. Any reporting of Elsevier/HESI scores pertaining to individual students must be approved by the IRB prior to initiation of any Elsevier/HESI-related project.
(4) Once the final analysis of the data is complete, the faculty member must provide electronic copies of all spreadsheets or other types of files generated from statistical software packages and/or word processing programs. Any electronic files stored on the hard drive(s) of faculty member's computers must be destroyed once the data have been returned to Elsevier/HESI, and Elsevier/HESI has (1) confirmed receipt of returned files; and (2) determined that the files are uncorrupted, accessible on our computer systems, and complete.
(5) The faculty member will receive recognition (depending on the level of involvement with the project) as a co-author or lead author on related manuscripts prepared for publication.

The title of my study is: Effect of Implementation of Simulation on Critical Thinking Skills in Undergraduate Baccalaureate Nursing Students

This agreement is for the timeframe June 15, 2016 (Month/Day/Year) to December 31, 2017 (Month/Day/Year).

For any questions, contact:
Terry Throckmorton, PhD, RN, Principal Researcher
Health Sciences • Elsevier, Inc.
Office: 713-346-6927 FAX: 713-346-6970 t.throckmorton@elsevier.com

We are pleased that you chose Elsevier/HESI-focused research. Thanks for participating, and we look forward to seeing your results!

ACCEPTED AND AGREED:

Joanne M. Knoesel
(Print Name) 08/11/16

Terry Throckmorton, PhD, RN
(Print Name) 01/16/16
Appendix D. Pace University IRB Approval

![Pace University Logo]

INSTITUTIONAL REVIEW BOARD (IRB)
NOTIFICATION OF REVIEW

To: Joanne Knoesel, MSN
From: Pace University Institutional Review Board
Date: October 18, 2016
IRB Code #: 10-112
Project Title: [9885112] Effect of Implementation of Simulation on Critical Thinking Skills in Undergraduate Baccalaureate Nursing Students
Study Review: Exempt Review
Action: Approved
Expiration Date: October 13, 2017

Thank you for your submission of New Project materials for this project. The above-referenced human-subjects research project was APPROVED by the Pace University Institutional Review Board (IRB) for the period of October 14, 2016 through October 13, 2017.

Approval is limited to the activities described in the approved Protocol Narrative. Additional conditions for the general conduct of human-subjects research are detailed on the Office of Sponsored Research website (http://www.pace.edu/offices-sponsored-research/research-protections-IRB-IACUC).

Federal regulations require that all research be reviewed at least annually. It is the Principal Investigator’s responsibility to obtain review and renewed approval 30 days before the expiration date of the protocol. If there is a lapse in approval, you may not continue any research activity (i.e., enroll participants, engage in study procedures, or analyze identifiable data) until the IRB renewal is reviewed and approved.

Please contact the IRB when you need to:
- Renew your project (please submit a continuing approval form at least 30 days prior to expiration);
- Submit a final report when the project is completed;
- Revise any aspect of the approved protocol. All changes (e.g., change in procedure, personnel, recruitment materials, etc.) must be prospectively reviewed and approved by the IRB, or
- Report any unanticipated problems involving risk to subjects or any serious adverse events.

Please send all communication to paceirb@pace.edu; all forms and additional information can be found on the Pace IRB website.

Thank you for your continuing cooperation, and best of luck with your research.

Sincerely,
Appendix E. CUNY Graduate Center IRB Approval

11/16/2016

Joanne Knossel,
The Graduate School & University Center

RE: IRB File #2016-1385
Effect of Implementation of Simulation on Critical Thinking Skills in Undergraduate Baccalaureate Nursing Students

Dear Joanne Knossel,

Your Initial Application was reviewed and approved on 11/16/2016. You may begin this research.

Please note the following information about your approved research protocol:

Protocol Approval Period: 11/16/2016 - 11/16/2019
Protocol Risk Determination: Minimal

Documents / Materials:

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Version #</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curriculum Vitae</td>
<td>Joanne M. Knossel</td>
<td>1</td>
<td>10/15/2016</td>
</tr>
<tr>
<td>Email Text</td>
<td>Pace University IRB approval</td>
<td>1</td>
<td>10/20/2015</td>
</tr>
<tr>
<td>Scientific Sponsorship</td>
<td>Terry Thompson/Elonie</td>
<td>1</td>
<td>10/15/2015</td>
</tr>
<tr>
<td>Other Data Collection</td>
<td>CIT Training for Human Subject Research</td>
<td>1</td>
<td>10/15/2015</td>
</tr>
<tr>
<td>Other Data Collection</td>
<td>NIH research training certificate</td>
<td>1</td>
<td>10/15/2015</td>
</tr>
</tbody>
</table>

Please remember to:

- Use the IRB file number 2016-1385 on all documents or correspondence with the IRB concerning your research protocol.

- Review and comply with CUNY Human Research Protection Program policies and procedures.
The IRB has the authority to ask additional questions, request further information, require additional revisions, and monitor the conduct of your research and the consent process.

If you have any questions, please contact:
Zoltan Boka
718-990-4108
ZOLTAN.BOKA@lehman.cuny.edu
Appendix F. Simulation Effectiveness Tool – Modified (SET-M)

<table>
<thead>
<tr>
<th>Simulation Effectiveness Tool - Modified (SET-M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>After completing a simulated clinical experience, please respond to the following statements by circling your response.</td>
</tr>
<tr>
<td><strong>PREBRIEFING:</strong></td>
</tr>
<tr>
<td>Prebriefing increased my confidence</td>
</tr>
<tr>
<td>Prebriefing was beneficial to my learning</td>
</tr>
<tr>
<td><strong>SCENARIO:</strong></td>
</tr>
<tr>
<td>I am better prepared to respond to changes in my patient’s condition</td>
</tr>
<tr>
<td>I developed a better understanding of the pathophysiology</td>
</tr>
<tr>
<td>I am more confident of my nursing assessment skills</td>
</tr>
<tr>
<td>I felt empowered to make clinical decisions</td>
</tr>
<tr>
<td>I developed a better understanding of medications. (Leave blank if no medications in scenario)</td>
</tr>
<tr>
<td>I had the opportunity to practice my clinical decision making skills</td>
</tr>
<tr>
<td>I am more confident in my ability to prioritize care and interventions</td>
</tr>
<tr>
<td>I am more confident in communicating with my patient</td>
</tr>
<tr>
<td>I am more confident in my ability to teach patients about their illness and interventions</td>
</tr>
<tr>
<td>I am more confident in my ability to report information to health care team</td>
</tr>
<tr>
<td>I am more confident in providing interventions that foster patient safety</td>
</tr>
<tr>
<td>I am more confident in using evidence-based practice to provide nursing care</td>
</tr>
<tr>
<td><strong>DEBRIEFING:</strong></td>
</tr>
<tr>
<td>Debriefing contributed to my learning</td>
</tr>
<tr>
<td>Debriefing allowed me to verbalize my feelings before focusing on the scenario</td>
</tr>
<tr>
<td>Debriefing was valuable in helping me improve my clinical judgment</td>
</tr>
<tr>
<td>Debriefing provided opportunities to self-reflect on my performance during simulation</td>
</tr>
<tr>
<td>Debriefing was a constructive evaluation of the simulation</td>
</tr>
<tr>
<td>What else would you like to say about today’s simulated clinical experience?</td>
</tr>
</tbody>
</table>

References


Pearson, A. (2004). Balancing the evidence, incorporating the synthesis of qualitative data into systematic reviews. *JBI Reports, 2*(2), 45-64.


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