THE EFFECT OF SIMULATION ON KNOWLEDGE, SELF-CONFIDENCE, AND SKILL PERFORMANCE

by

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Dedication

This dissertation is dedicated to my family who supported me through this endeavor and assisted me with completing this journey. They journey has been long and filled with bumps in the road but ultimately it has been worth it. Thanks to my husband Doug; and my children David, Jonathon, and Maria who are the light of my world.

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The Effect of Simulation on Knowledge, Self-Confidence, and Skill Performance

Abstract

by

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Current research supports that using simulation for nursing education will increase a student's knowledge and self-confidence, but only a handful of research studies have looked at the effect of simulation on skill performance. The purpose of this study is to examine the effect of two educational interventions on measures of knowledge, self-confidence, and skill performance in junior level BSN nursing students.

A nonequivalent control group pretest posttest design was used to examine and compare the effects of the two educational interventions, medium-fidelity simulation and low-fidelity simulation (paper/pencil case study). The student's knowledge was measured using a multiple choice test, self-confidence was measured with the Self-Confidence in Learning Scale, and skill performance was measured using an objective structured clinical examination (OSCE). The OSCE has been routinely used in medicine to assess medical students' clinical abilities and is just beginning to be used in nursing.

A pilot study was conducted with a convenience sample of junior nursing students (n = 21) to determine the feasibility of the medium-fidelity and low-fidelity simulations, the knowledge test, and the OSCE. For the full study, the participants consisted of a convenience sample of all students enrolled in a pediatric nursing course (n = 73).

The results of the study indicated that there was a statistically significant difference in self-confidence between the groups with the low-fidelity group scoring higher than the medium-fidelity group. This is an unexpected finding as previous studies have supported that self-confidence was higher in medium-fidelity groups. There also was a statistically significant difference between the pretest and posttest scores on knowledge and skill performance, but not between the two groups. This indicates that medium-fidelity simulation did not result in a higher level of knowledge or skill performance than low-fidelity simulation. Medium-fidelity simulators have a higher cost, both in dollars and faculty time, than low-fidelity simulation. Faculty members and nursing institutions need to identify what the learning outcomes of the educational experience are and determine if a lower technology, that is less expensive and less labor intensive, will have the same learning outcomes as the higher technology.

Chapter I

Introduction

The human patient simulator is an educational tool that has been used in health care education to promote learning in health care professionals. Simulation has been shown to be an excellent educational intervention to enhance nursing students' satisfaction with the learning experience, increase students' self-confidence, and enhance students' perception of increased skill performance (Jeffries & Rizzolo, 2006). Students perceive that they have an increase in skill performance, but do they actually have an increase in their ability to provide better care to their patients? With the cost of simulators ranging from $7,000 to $65,000 (http://www.laerdal.com/nav/29948425/Patient-Simulators.html), it is important to know if students have an actual increase in skill performance. Educational facilities are investing significant amounts of money into an educational intervention that has not demonstrated effectiveness in enhancing student's skill performance.

In addition to the actual cost of the equipment, consideration must be given to the special training required by the nursing educator as well as the extra time needed to develop an effective simulation experience for nursing students. A typical simulation experience will last 40 minutes (twenty minutes for simulation activity and twenty minutes for reflection) for a group of four to five students (Jeffries, 2007). To enhance the benefits of the simulation experience, simulations are recommended to be used with small groups (Jeffries, 2007). For an average class size of 50 students, this would mean running the same simulation experience ten times for a total of 6 hours and 40 minutes. For a class size of one hundred students, this would be 13 hours and 20 minutes and a total of 20 times for the same simulation.

To provide an effective simulation experience, there must be another individual to assist the nursing instructor with preparing the human patient simulator and running the simulator during the activity. This allows the nursing instructor to focus on the students and enhance their learning. Six to thirteen hours is needed to run one educational simulation activity. If multiple simulations are incorporated into a nursing course, nursing instructors may find themselves spending a week or two working just on developing and implementing simulation experiences for their students. This is a great expenditure of faculty resources and money to enhance nursing students' satisfaction with the learning experience, increase students' self-confidence, and enhance students' perception of increased skill performance.

Current research studies have identified a statistically significant difference on nursing student's self-confidence and skill performance between education using medium or high fidelity simulation and the traditional lecture-only educational experience (Alinier, Hunt, Gordon, & Harwood, 2006; Jeffries & Rizzolo, 2006). Researchers in medicine who compared the effects of medium and high fidelity simulation versus low-fidelity simulation, such as case study or problem-based learning, did report statistically significant differences in medical students' self-confidence but not a statistically significant difference in knowledge or skill performance (Morgan, Cleave-Hogg, McIlroy, & Devitt, 2002; Schwartz, Fernandez, Kouyoumjian, Jones, & Compton, 2007; Wenk et al., 2009). One of the most recent studies in medicine, conducted by Wenk et al., reported that medical students who received high-fidelity simulation education had a higher level of self-confidence than a group of students who received low-fidelity simulation (problem based learning). Wenk et al. also reported that even though the

students in the simulation group had an increase in self-confidence, they did not have a statistically significant higher difference in skill performance. This increase in self-confidence may be problematic as students may attempt skills and provide care that they are not yet capable of performing.

Simulation is a current up and coming topic in nursing education and the literature is inconclusive on the impact of simulation on students' knowledge, self-confidence, and skill performance. Prior to investing time and money into incorporating the medium and high fidelity simulators as educational interventions in schools of nursing throughout the United States, research needs to be conducted to determine if there are other learning benefits to the simulated experience beyond enhanced learner satisfaction, increased self-confidence, and increased learner's perceived skill performance. It is also important to consider whether the human patient simulator is the most effective tool to use for experiential learning when time and costs are evaluated. In this study, the researcher explored the effects of a medium fidelity simulation educational experience versus a low-fidelity simulation educational experience on pediatric nursing students' knowledge, self-confidence, and skill performance.

Theoretical Framework

Experiential learning has been shown to be an effective learning method for practice disciplines to learn psychomotor and critical thinking skills in order to provide safe and effective care to patients. Benner (1984) suggested that experiential learning experiences can be used to assist the novice and advanced beginning nurse with assessment, identifying nursing interventions, and providing safe and accurate care for their patients. Kolb (1984) described the process of experiential learning that explained

how an individual learns and applies knowledge learned from an experiential learning experience.

Kolb's Experiential Learning Theory. Kolb (1984) described the process of experiential learning as a four-stage cycle that involved four adaptive learning modes: concrete experience, reflective observation, abstract conceptualization, and active experimentation. In order to learn an individual must have a concrete experience (listen to adult heart beat), reflect on the observation (remember what the adult heart beat sounded like), abstractly conceptualize the experience (generate an idea that this is what all heart beats sound like), then actively experiment to verify that the abstract conceptualization is accurate (An infant's heart beat will sound the same, but be faster.). One of the essential ideas in Kolb's theory is that learning, and therefore knowing, requires a grasp (or figurative representation) of the experience with some type of transformation of that representation. The experience must be transformed into learning and stored in the brain for future use. Kolb (1984) states "learning is the process whereby knowledge is created through the transformation of experience" (p. 38).

Zull's further explanation of Kolb's Theory. Zull (2002) has taken Kolb's theory further and linked the stages of the learning cycle with what is occurring in the brain during each of the stages. Zull's explanation of how knowledge is stored and learning occurs begins with the neuron, the building block of the brain. The brain is made up of over 100 billion neurons, which store the knowledge that an individual has learned (Zull, 2002). The neurons in the brain form neuronal networks. A neuronal network consists of multiple neurons that contain all of the stored information regarding a specific topic, such as what a heart beat sounds like. One neuronal network is then

connected with others to form an even larger network. A large neuronal network that most nurses will have is the knowledge of how to take a manual blood pressure. This large neuronal network would consist of smaller neuronal networks that consist of how to apply the blood pressure cuff, how to use a stethoscope, what the blood pressure sounds like, and how to read the sphygmomanometer.

Neurons and the neuronal networks are important in experiential learning because these are the areas where knowledge is stored. These neuronal networks exist in every part of the brain (cerebral cortex), but specific types of knowledge are stored in different areas of the brain. The sensory cortex, in the back of the brain, stores knowledge obtained from sensory input, for example the sound of a heart beat (Zull, 2002). The back integrative cortex stores knowledge gained from the sensory input in the form of images and meaning (Zull, 2002). An example would be a picture of a heart beating that is linked to the sound of the heart beat. This is knowledge that is now stored permanently in the individual's long-term memory in this part of the brain, the back integrative cortex. The frontal integrative cortex is responsible for short term memory and allows an individual to retrieve the image of the heart beating and think about what that heart beat would sound like in an infant whose heart beats at 160 beats a minute. The motor cortex, in the front part of the brain, produces movement (Zull, 2002). The motor cortex would be responsible for placing the stethoscope on the chest of an infant to listen to the heart beat. Once the stethoscope is placed on the infant's chest, the individual is testing what they believe the heart beat will sound like (frontal integrative cortex), hearing the infant's heart beat (sensory cortex), and storing the sound of the heart beat with the picture of an infant (back integrative cortex).

This flow of knowledge from the front to the back of the brain is further enhanced by the shape of the brain. The cerebral cortex of the brain is shaped like a backwards C which allows for knowledge to flow naturally from the front of the brain to the back of the brain and from the back of the brain to the front of the brain (Zull, 2002). These structures of the brain and their functions match with each stage of the learning process (Zull, 2002). The concrete experience involves the sensory cortex, reflective observation involves the integrative cortex at the back, creating new abstract concepts occurs in the frontal integrative cortex, and active testing involves the motor brain (see Figure 1).

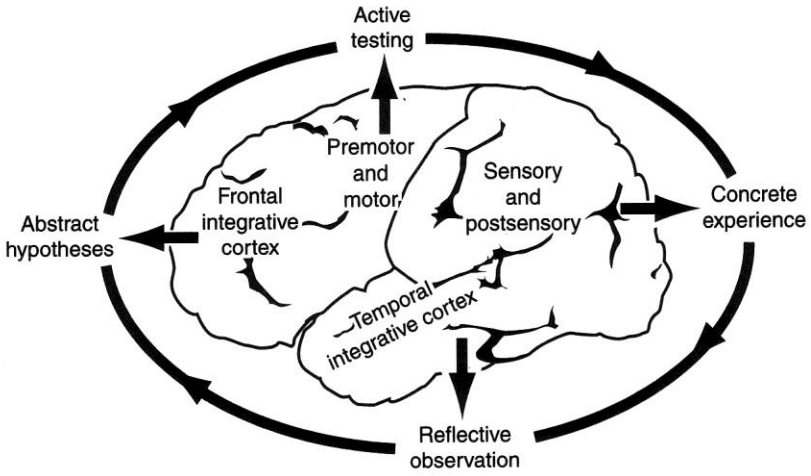

Figure 1. Integration of Zull's brain activity and Kolb's Experiential Learning Theory

Figure 1: Integration of Zull's brain activity and Kolb's Experiential Learning Theory. Retrieved from http://www.case.edu/artsci/biol/people/zull.html Reprinted with permission from James E. Zull

Zull (2002) further states that for individuals to learn they must feel safe and be motivated to learn. In the brain, there are two competing regions: The pleasure center (basal structures – Zull's name for the area) and the fear center (the amygdala) (Zull, 2002). The pleasure center is located at the front of the brain, the front part of the brain is

about action, and the fear center is located in the back of the brain (deep in the cerebral cortex). For learning to occur, the student must feel safe so that they can allow the learning that they gain from the concrete experience to flow from the back of the brain to the front of the brain where the experience with be conceptualized and stored in the brain. The instructor must create an environment that allows the amygdala to not overreact which will allow learning to occur and information to be stored in the appropriate regions of the brain. The learner's sense of control and belief that they are making progress (occurring in the front of the brain) activates the individual's pleasure center which results in the individual having an increased willingness to learn.

Nursing is a hands-on profession and students must demonstrate their ability to apply the concrete knowledge that they have learned in patient settings. In order for this to occur, students need to be taught, not only through lecture, but also through active engagement with the knowledge through the use of experiential learning. This will allow not only the back portion of the brain to be used for learning, but also the front portion of the brain and will allow for the natural flow of energy in the brain to promote learning (Zull, 2002). Two teaching strategies in nursing that have been used to actively engage students are medium-fidelity simulation and low-fidelity simulation (paper/pencil case study). Both of these teaching strategies will provide the students with the ability to take the knowledge they have learned in lecture and stored in the back of the brain and actively test the knowledge through medium-fidelity or low-fidelity simulation and store the information in the front portion of the brain. These students are then fully engaged in the experience and making neuronal connections that are enhancing their learning.

Medium-fidelity and low-fidelity simulations are both situations that decrease students' fear center and allow for knowledge to flow from the back to the front of the brain. Also, these experiences allow the students to apply what they have learned and accurately use the knowledge in the medium-fidelity and low-fidelity simulation, so there is pleasure in the learning. Because the medium-fidelity simulation experience is a more hands-on experience and students engage more of their senses, they are making more neuronal connections in the medium-fidelity simulation than the low-fidelity simulation (paper/pencil case study) where they are only using their hearing and vision (visual prompts). The medium-fidelity simulation experience will result in more neuronal connections being made, so students will have more stored knowledge of the experience.

Based on Kolb's theory and Zull's further explanation of the Experiential Learning Theory, experiential learning is a way to promote student's learning. Two experiential learning educational experiences in nursing are medium-fidelity simulation and low-fidelity simulation (paper/pencil case study). Both of these experiences will allow for the natural flow of energy from the back to the front and the front to the back of the brain again as the student moves from the concrete experience to active testing to abstract hypothesis and finally to reflective observation. Both of these methods allow the instructor to provide a safe environment for learning to occur since there is no actual patient that can be harmed by potentially incorrect nursing assessments or nursing actions. Both of these experiences allow for creating neuronal networks and connections between multiple neuronal networks, but medium-fidelity simulation will allow for more connections to be made since students are using more of their senses than just hearing and vision. A key difference between these experiences is that the low-fidelity

simulation (paper/pencil case study) is more cost effective and requires less faculty time than the medium fidelity simulation experience. Thus, the purpose of this research study is to test if a medium fidelity simulation will result in a higher level of knowledge, self-confidence, and skill performance than low-fidelity simulation (paper/pencil case study).

Research Question

Do junior BSN pediatric nursing students who receive a medium-fidelity simulation learning experience have a higher level of (a) knowledge, (b) self-confidence, and (c) skill performance than nursing students who receive a low-fidelity simulation (paper/pencil case study)?

Research Hypotheses

1. Nursing students who receive a medium-fidelity simulation learning experience will have higher knowledge scores than students who receive the low-fidelity simulation (paper/pencil case study) learning experience.
2. Nursing students who receive a medium-fidelity simulation learning experience will have higher self-confidence scores than students who receive the low-fidelity simulation (paper/pencil case study) learning experience.
3. Nursing students who receive a medium-fidelity simulation learning experience will have higher skill performance scores than students who receive the low-fidelity simulation (paper/pencil case study) learning experience.

Chapter II

Literature Review

The literature review begins with the conceptual definition for the two educational interventions, low-fidelity simulation (paper/pencil case study) and medium-fidelity simulation, and the three dependent variables, knowledge, confidence, and skill performance. The literature was reviewed for studies that compare the effects of the educational intervention, simulation, versus other types of educational interventions on knowledge, self-confidence, and skill performance. Finally, the gaps in the research literature are discussed.

Experiential Learning Experience

Kolb (1984) identified the process of experiential learning as a four-stage cycle that involved four adaptive learning modes: concrete experience, reflective observation, abstract conceptualization, and active experimentation. Kolb defined learning as the "process whereby knowledge is created through the transformation experience" (p. 38). In nursing, experiential learning experiences that lead to knowledge creation include low-fidelity simulation, medium-fidelity simulation, and high-fidelity simulations. "Fidelity refers to the extent which a simulation mimics reality" (Jeffries, 2007, p. 28). A low-fidelity simulation has little to no interactive features (paper/pencil case study) (Jeffries, 2007). A medium-fidelity simulation will have some features that mimic reality, such as a chest that looks real and has heart sounds that can be heard, but does not rise and fall like a real chest (Jeffries, 2007). A high-fidelity simulation incorporates a sophisticated, computerized mannequin that mimics a real live patient into the learning experience

(chest rises and falls, pupils dilate, etc.) (Jeffries, 2007). In this study, a medium fidelity simulation will be compared to a low-fidelity simulation (paper/pencil case study).

Outcomes of Experiential Learning Experience

Jeffries (2005) identified five typical learning outcomes that are associated with undergraduate nursing education that may result from a simulation learning experience. These outcomes are nursing knowledge, skill performance, learner satisfaction, critical thinking, and self-confidence. In this study, the outcomes of nursing knowledge, self-confidence, and skill performance were evaluated. Nursing knowledge includes both theoretical knowledge (knowing that) and practical knowledge (knowing how) (Benner & Wrubel, 1982). In this study, knowledge is defined as a nursing student's theoretical knowledge about caring for pediatric nursing patients. Jeffries and Rizzolo (2006) assessed nursing students' self-confidence in providing care for a postoperative adult patient. In this study, self-confidence is defined as a nursing student's confidence in his or her ability to provide care for a pediatric patient. Skill performance in healthcare refers to the ability of an individual to perform psychomotor skills (Jeffries, 2007). Psychomotor skills are skills that require both mental and motor ability. In this study, skill performance is defined as the ability to perform accurately a required psychomotor skill.

The outcomes of learner satisfaction and critical thinking were not evaluated in this study. Learner satisfaction has been shown to increase significantly when students are educated using simulation (Jeffries & Rizzolo, 2006). Learner satisfaction does not have a direct impact on patient outcomes, so was not included in this study. Critical thinking is a complex concept that is a "catch-all" phrase for the many forms of thinking

in nursing (Benner, Sutphen, Leonard, & Day, 2010). There is also no consensus in nursing on how to measure or define critical thinking (Ravert, 2008). Benner et al., "supports a shift from an emphasis on critical thinking to an emphasis on clinical reasoning" (p. 84). The lack of consensus on how to define and measure critical thinking and the emphasis to shift to the term critical reasoning are why critical thinking was not included in this study.

Knowledge

Research studies that compared the group differences in knowledge scores for students receiving simulation versus traditional lecture or another educational learning experience were reviewed. Two studies reported a statistically significant difference between students who received the simulation experience and students who did not (Ackermann, 2009; Brannan, White, & Bezanson, 2008). These two studies also reported a statistically significant difference pre and post intervention for the control and treatment group (simulation experience). Seven studies reported no statistically significant difference between the group who received simulation education and the control group, but reported a significant difference between pre and post test scores for both groups (Becker, Rose, Berg, Park, & Shatzer, 2006; Gordon et al., 2006; Kardong-Edgren, Lungstrom, & Bendel, 2009; Jeffries & Rizzolo, 2006; Knudson & Sisley, 2000; Multak, Euliana, Gabrielli, & Layon, 2002; Wenk et al., 2009). Morgan et al. (2002) also reported no statistically significant differences between two groups on a post intervention knowledge test. Of these eight studies, none of these studies included any information regarding reliability of the instrument used to measure knowledge and only Jeffries and Rizzolo (2006) identified how they had established content validity. Three studies

reported no difference between the group who received simulation education and the control group and also reported no statistically significant differences between pre and post test scores for both groups (Griggs, 2003; Kardong-Edgren, Anderson, & Michaels, 2007; Scherer, Bruce, & Runkawatt, 2007). These three studies had small sample sizes which may have resulted in the nonsignificant findings.

Improvement in knowledge between groups. Ackerman (2009) compared the effects of teaching cardiopulmonary resuscitation (CPR) using the standard American Heart Association CPR for adults review and the standard CPR review with an additional high-fidelity simulation experience using a cardiopulmonary arrest scenario on the initial acquisition and the 3-month retention of CPR knowledge for junior level BSN students. Knowledge was measured using test questions from the AHA exam for Basic Life Support with any questions not dealing with Adult CPR or the use of the Automatic External Defibrillator (AED) being removed from the test. The instrument was identified as reliable, (Cronbach's alpha = 0.799) but no discussion of validity was included in the article. All scores were analyzed for variance of means (ANOVA). Both the control group ($p = .000$) and the experimental group (.001) demonstrated an increase in knowledge between the pretest and posttest. The experimental group, which received the simulation education in addition to the traditional education, showed significantly higher acquisition of skills ($p = .015$) and retention of knowledge ($p = .002$) than the control group. No methodological or statistical concerns were identified in the report.

Brannan, White, & Bezanson (2008) compared the effectiveness of traditional lecture versus education with the human patient simulator (HPS) on junior level nursing student knowledge. Something unique to this study is that the students in the human

patient simulator group only received education using the human patient simulator without a component of lecture. Knowledge was measured using parallel forms of Acute Myocardial Infarction Questionnaire that was developed by the researcher. There was no mention of validity of the instrument, but reliability of the parallel forms was determined to have internal consistency (Spearman-Brown reliability coefficient of 0.74), but no discussion of reliability of the instrument for the current study. The intervention group was determined to have a higher pretest score than the control group ($t = -2.5$, $df = 96$, $p = .01$) so regression analysis was used by the researchers to control for this. The intervention group, who received simulator education only, had significantly higher posttest scores than the group who received traditional lecture-only education ($t = 2.0$, $df = 79$, $p = .05$). No statistical concerns were identified in the study, but differences in the pretest scores between the two groups, even though controlled with statistics, are a concern.

Knowledge increase, no difference between groups. A multi-state, multi-site study conducted by Jeffries and Rizzolo (2006) to evaluate simulation as part of a teaching/learning experience for nursing students, was conducted in four phases. During the third phase, part one of the study, a group of 395 students was evaluated on a knowledge test of care of the post-operative adult patient. All subjects received the same traditional lecture teaching experience (videotaped) and results showed a statistically significant increase in knowledge between the pretest (prior to the education) and the posttest. Once this had been established, during part two of the third phase, the videotaped educational experience and knowledge test were used to evaluate if there was any difference in knowledge based on the type of simulation experience, paper/pencil

case study, static mannequin, or high-fidelity patient simulator (n = 403). No significant difference was found among the three groups as measured by pre and post testing using Kruskal-Walis non-parametric tests between each pair of groups. No p value was included in the report of this finding. Since no statistically significant difference was identified among the three groups, knowledge was not measured during the fourth phase of the multistate, multisite project.

During phase three of the multi-state, multi-site study, knowledge was measured with a 12-item multiple-choice test that had content validity established by three experienced faculty, but no reliability of the instrument was noted (Jeffries & Rizzolo, 2006). The researchers also stated that because the simulation experience was meant for the nursing students to apply knowledge and not gain new knowledge, this finding was not surprising. No methodological concerns were identified by the researchers; however p values and reliability of the instrument were missing.

Kardong-Edgren et al. (2009) evaluated the effect of simulation experience and time on student's knowledge and retention of knowledge regarding acute coronary syndrome. There were three groups in the study, with one group receiving lecture only and the other two groups receiving a 30 minute simulation experience (15 minute simulation and 15 minutes for debriefing). The two simulation groups received identical simulation experiences, but used two different simulation mannequins: VitalSim® and SimMan®. Knowledge was measured using a researcher developed 15 question multiple choice test. No discussion of validity or reliability of the instrument was included in the article. All scores were analyzed for variance of means (ANOVA). There was a significant main effect for time ($p < .0001$) but no main effect for simulator. There was a

statistically significant difference between the pretest and first posttest for all three groups but no difference between the groups. There was a statistically significant decrease in knowledge scores between the first and second posttest for all three groups as well, but no p value was reported. There were some methodological concerns identified in this study as the control group was located on a distance campus which did not have simulation mannequins on site. This may have led to the students in the control group studying for the knowledge test as they were competing with the students on the main campus who had access to the simulation mannequin (Kardong-Edgren et al., 2009).

Three studies compared medical students knowledge using simulator-based education versus another educational intervention (control group) using a form of analysis of variance. (Gordon et al., 2006; Knudson & Sisley, 2000; Wenk et al., 2009) Gordon et al. compared simulator-based teaching with the traditional instruction using ANCOVA. Using repeated measures ANOVA, Knudson and Sisley compared real-time ultrasound machine (simulator) versus the traditional hands-on medical models/medical patients. Wenk et al. compared simulation-based training versus problem-based discussion and knowledge of rapid based induction (anesthesia). The knowledge data were analyzed utilizing repeated measures ANOVA. All three of these studies found statistically significant results between the pretest and posttest for both the simulation and control group, but no differences between the simulation and control group on posttest knowledge. None of these studies reported the p value for differences between the groups on the posttest, or reliability and validity of the knowledge instruments.

All three studies had some methodological concerns and the researchers in two of the studies identified possible methodological or statistical reasons for the lack of

statistically significant findings. Gordon et al. discussed concerns about having one instructor do the simulation education on respiratory and cardiac and two different instructors conduct the respiratory and cardiac lectures. There were also two different versions of the knowledge test (instrument). The blinding of instructors to each other's activities made it "difficult to ensure a reliable correlation between the instructional material and testing instrument" (Gordon et al., 2006, p. 37). Knudson and Sisley had a statistically significant difference on the pretest between the two groups ($p = .01$). This means that the two groups were not homogeneous and violated one of the assumptions for repeated measures ANOVA (Munro, 2005).

Researchers in two studies reported statistically significant differences between the pretest and posttest scores for control and treatment groups, but not between the two groups (Becker et al., 2006; Multak et al., 2002). In both studies, the researchers conducted multiple t tests on the knowledge data. The use of multiple t-tests escalates the significance and increases the risk of a type I error (Burns & Grove, 2009). To control for the escalation in significance a researcher must use the Bonferroni correction or use another statistical test, such as ANOVA. Even though the researchers in both of these studies reported that there was a statistically significant difference in knowledge between the pretest and the posttest scores, this may not be accurate since they used multiple t-tests and did not use the Bonferroni correction to control for escalation (Becker et al., 2006; Multak et al., 2002).

No knowledge difference between posttest scores. Morgan et al. (2002) compared the outcome of knowledge on a written examination between medical students given simulator-based education or videotaped education on caring for a patient with

myocardial ischemia (n = 43), anaphylaxis (n = 48), or hypoxemia (n = 53). The researchers reported no significant differences between the simulator and videotaped education, but there were some methodological concerns that may have resulted in not identifying a statistically significant difference between the two groups. Morgan et al. reported no reliability or validity information about the knowledge test.

No increase in knowledge. Griggs (2003) assessed nursing student's medical knowledge between a group of students who received simulation and traditional classroom teaching and a group of students who only received classroom teaching (total n = 27). Scherer et al. (2007) assessed nurse practitioner student's knowledge regarding managing a cardiac event between a group of students who individually participated in the rapid arterial fibrillation case scenario simulation exercise and a group who participated in a faculty-run seminar using the same case scenario (total n = 23). In both of these studies, the researchers found no difference in pre and posttest scores in the experimental or control group. This brings into question the findings of both of these research studies since an improvement from pretest to posttest knowledge scores is an expected outcome after an educational intervention. The small sample size may have resulted in not finding a significant difference between the two groups when an actual difference existed (Type II error) (Lipsey, 1990). A total sample size of 128 participants is needed for adequate power (.80) for studies analyzing differences between group means using t-tests (Faul, Erdfelder, Lang, & Buchner, 2007).

Kardong-Edgren et al. (2007) assessed nursing student's knowledge of congestive heart failure between three groups of students (total n = 14). All three groups received a 15 minutes lecture on Congestive Heart Failure with the second group receiving 15

minutes static mannequin simulation and the third group received a 15 minute simulation experience with SimMan®. There was no difference in pre and posttest knowledge scores between the three groups ($F(2, 11) = 1.687$, $p > .05$). The small sample size may have contributed to not finding a significance difference between the three groups. A total sample size of 42 participants is needed for adequate power (.80) for studies analyzing the differences between groups using repeated measures ANOVA (Faul, Erdfelder, Lang, & Buchner, 2007). The short period of time of just 15 minutes of lecture and 15 minutes with the simulation experiences may also have contributed to not seeing an increase in student knowledge between the pre and posttest.

Gaps in knowledge literature. Based on findings from this review it is unclear if simulation as an experiential learning experience has a higher effect on student's knowledge than other learning experiences. This study is designed to investigate the effect of medium-fidelity simulation versus low-fidelity simulation (paper/pencil case study) on the measure of knowledge and to improve on previous studies by adding more stringent controls and assessing reliability and validity of the knowledge instrument.

Confidence

In research studies that compared the group differences in confidence scores for students receiving simulation versus traditional lecture or another educational learning experience, seven studies reported a statistically significant difference between the two groups (Brown & Chronister, 2009; Butler, Veltre, & Brady, 2009; Jeffries & Rizzolo, 2006; Marshall et al., 2001; Scherer, Bruce, & Runkawatt, 2007; Tiffen, Graf, & Corbridge, 2009; Wenk et al., 2009). Three of these studies have questionable results (Brown & Chronister, 2009; Scherer et al., 2007; Tiffen et al., 2009). Five studies

reported no statistically significant difference between the two groups (Alinier, Hunt, Gordon, & Harwood, 2006; Birch et al., 2007; Brannan, White, & Bezanson; Cioffi, Purcal, & Arundell, 2005; Lambton & Dudum, 2008). Of the five studies that reported no statistically significant difference between groups, three of these studies had some significant methodological and statistical issues as the researchers did not clearly identify how confidence was measured (Birch et al., 2007; Cioffi et al., 2005; Lambton & Dudum, 2008).

Cioffi et al. reported that there was a higher confidence in the midwifery students who participated in the simulation strategy, but not a statistically significant difference. No information on p values or statistical tests that were used to analyze the data were included in the report. Birch et al. also did not report the p values or statistical test used to analyze the difference in confidence level among teams who received simulation-based training, lecture-based training, and lecture and simulation training, but reported no significant difference among the groups. Lambton and Dudum (2008) also found no statistically significant difference in confidence for a group of pediatric nursing students who received simulator training. No statistical results could be identified in the study that supported this information and the only instrument reported in the study was a ten question survey developed by three content experts to capture the construct of collaboration, communication, error recognition, and age-appropriate assessment. Based on this information, it is unclear how Lambton and Dudum came to this conclusion.

Difference in confidence level. Jeffries and Rizzolo (2006) and Butler et al. (2009) compared the effects of different levels of simulation on nursing students' self-reported confidence levels. Jeffries and Rizzolo reported that nursing students who

received education on the care of the adult post-operative patient via high-fidelity simulator or a static mannequin reported significantly greater confidence than students who received education using a paper/pencil case study. Butler et al. reported a statistically significant difference in student satisfaction and self-confidence in learning between a group of nursing students who were taught by low-fidelity versus high-fidelity simulation ($t = -3.362$, $p = .004$). Both of these studies used the same instrument to measure self-confidence, the Self-Confidence in Learning Instrument developed by the NLN. This instrument was developed by Jeffries and Rizzolo (2006) for utilization in a multi-state, multisite study that evaluated the effects of simulation on student learning outcomes. This instrument has been shown to have good internal consistency with reported Cronbach's alpha of 0.87 (Jeffries & Rizzolo, 2006) and 0.90 (Butler et al., 2009). Content validity was established by a group of nine clinical nurse experts. Both of these studies had overall sound methodological and statistical analysis. Butler et al. did use multiple t-tests when analyzing the effect of simulation on student's perception of the learning process, but no statistical problems were identified for the data analysis of student self-confidence.

Wenk et al. (2009) evaluated the efficacy of simulation-based teaching compared to problem-based discussion groups when teaching anesthesia to medical students. Confidence was measured pre and post intervention and both groups showed a statistically significant increase in scores between the pre and post intervention ($p < .001$). Statistical analysis was conducted using repeated measures ANOVA for all statistical tests. The simulation-based teaching group also had a significantly higher difference over the problem-based discussion group ($p < .05$). There was no reliability or

validity reported for the questionnaire that was used to measure self-confidence. The researchers did state that this had been done and were reported in their previous work. Overall no methodological or statistical concerns were identified.

Marshall et al. (2001) reported a statistically significant difference in a group of surgery residents (n = 12) after they had received advanced trauma life support training utilizing the human patient simulator (5.8 ± 0.9 to 8.1 ± 0.5, $p < .001$). The self-confidence scale included 20 items measured from 1 to 10, with 1 representing no confidence and 10 representing full confidence, with the average group score reported. The researchers reported that the instrument had been reviewed by the biostatistical department to ensure validity, but no reliability information was reported.

The last three studies that reported statistically significant differences in confidence between the simulation and control groups were all identified to have some methodological or statistical concerns. Brown and Chronister (2009) measured nursing students' confidence utilizing a 5-item questionnaire that focused on the different components of simulation. The items were ranked on a 5-point Likert scale with possible scores ranging from 5 to 25. Brown and Chronister analyzed the instrument for reliability (Cronbach's alpha .899 for the five-item questionnaire). When analyzing the confidence data, the researchers broke the questionnaire's data down by individual item and ran multiple t-tests on the data. There were 35 t-tests results reported from the data obtained from the five-item questionnaire on nursing students' confidence. Scherer et al. (2007) ran multiple t-tests when investigating the impact of simulation on acute care nurse practitioner students' confidence in managing a cardiac event. One group received education using the human patient simulator versus the control group who participated in

a faculty run seminar. Tiffen et al. (2009) also ran multiple t-tests when evaluating the difference in confidence level between a group of advanced practice nursing students who received one hour of simulation experience in addition to the lecture and laboratory time compared to the control group. The simulation experience focused on assessment of heart and lung sounds. The use of multiple t-tests escalates the significance and increases the risk of a type I error, stating that there was a statistically significant difference between the two groups when one truly did not exists (Burns & Grove, 2009). The results of all three of these studies are questionable.

No difference in confidence level. Two studies reported no statistically significant difference between the simulation group and comparison groups. Brannan et al. (2008) compared the effectiveness of human patient simulator method versus traditional lecture for treating a patient with an acute myocardial infarction on junior level nursing student's confidence level (n = 107). The confidence level instrument was a 34 item questionnaire, with four subscales, using a 4-point Likert scale that ranged from 1 to 4, with 4 being very confident. The researcher did report reliability of the instrument from previous studies (Cronbach's alpha .89), but no current reliability information or validity of the instrument was reported. The nonsignificant findings of the study may have occurred because of a lack of sensitivity of the instrument to measure the nursing student's confidence level. The researchers did state that they were not surprised by the findings as any teaching would naturally increase a student's confidence (Brannan et al., 2008).

Alinier et al. (2006) asked two-groups of nursing students (n = 99), one who received simulation-based training and one who did not, to rank their confidence with

working in a technological environment on a 5-point Likert scale (1, very confident; 5, not confident). The two groups did not differ significantly (Mann-Whitney U Test: $p = .819$). There may not have been a statistically significant difference between the two groups because the one item instrument was unable to measure differences between the two groups, and the researchers were asking about confidence in working in a technological environment. This is a very different concept of confidence than the other studies reported on in this literature review.

Gaps in confidence literature. Based on findings from this review it is unclear if simulation as an experiential learning experience has a higher effect on students' confidence level than other learning experiences. This study is designed to investigate the effect of simulation versus case studies on the measure of confidence and to improve on previous studies by adding more stringent controls and assessing reliability and validity of the confidence instrument.

Skill Performance

Evaluation of skill performance by simulation. Five studies compared the effects of high-fidelity simulation versus low-fidelity simulation on students' skill performance evaluated with a high-fidelity simulation. Researchers in three of the studies reported a statistically significant difference between the two groups (Ackermann, 2009; Steadman et al., 2006; Yoo & Yoo, 2003). Researchers in two studies did not report a statistically significant difference between the two groups (Morgan et al., 2002; Wenk et al, 2009). Ackerman (2009) compared the two educational interventions of cardiopulmonary simulation using the human patient simulation (high-fidelity simulation) plus standard American Heart Association (AHA) CPR for adults review versus just the

standard AHA education on skill performance in junior level nursing students. Skill performance was measured immediately following the educational experience (acquisition) and three months after the educational experience (retention). Ackermann reported a statistically significant increase in acquired skills ($p = .000$) and retention of skills ($p = .000$) for the experimental group who received the simulation training in additional to the standard education. Skill performance was measured using the AHA basic life support for Health Care Provider course final evaluation sheet for adult CPR. Possible scores ranged from 1 to 14 points. No validity of the skills sheet was reported, but validity may be assumed as this instrument was originally developed by a group of experts and is used daily to measure adult CPR skills. The instrument was determined to be reliable with a Cronbach's alpha of .74. No methodological or statistical concerns were identified in this study.

The other two studies in which the researchers reported statistically significant differences did have some methodological and statistical concerns regarding the reported results. Steadman et al. (2006) compared problem-based learning to high-fidelity simulation in fourth year medical students. Skill performance was evaluated with a pretest simulation and a posttest simulation experience. Steadman et al. reported that there was a statistically significant difference between the simulation and problem-based learning group in the mean change score (difference between pretest and posttest) ($p = .04$). The t-test was used to analyze the differences between the groups. Methodological concerns of the study are that the researchers used different simulation examination for the pretest and posttest and the final simulation exam was different for every student.

Also, the researchers conducted multiple t-tests to compare the differences between the two groups which increases the risk for a type I error.

Yoo and Yoo (2003) compared the effects of two teaching methods, lecture and lab versus standardized patients on skill performance of sophomore level nursing students. Yoo and Yoo reported that there was a statistically significant difference between the two groups but multiple repeated t-tests were conducted to analyze the difference between the two groups. At least ten t-tests were conducted in the study when analyzing the data and no Bonferroni correction was performed. Based on this information, the results of both of these studies are questionable due to the methodological and statistical issues that have been identified.

Morgan et al. compared the outcomes of simulator-based training versus videotape based training with medical students and did not find a difference between the two groups ($F_{1, 142} = 1.099$, $p = 0.296$). Wenk et al. evaluated medical student's skill performance between a group of students taught with the human patient simulator and a group taught through problem-based group discussion. No statistically significant differences were reported between the two groups ($p > .05$). Skill performance was measured pre and post intervention and repeated measures ANOVA was used to analyze the data in both studies. Neither study included information on reliability of the instrument used to measure skill performance, but both used a checklist format to measure the skill performance on the human patient simulator (high-fidelity). Wenk et al. did state that the skill performance was developed using the Delphi technique and six experts, but no discussion of reliability was included. Wenk et al. did have a small

sample size (n = 32) which may have resulted in not finding statistically significant results, but Morgan et al. had a large sample size of 144 medical students.

Evaluation of skill performance by OSCE. The Objective Structured Clinical Examination (OSCE) has been used in medicine since the mid 1970s to evaluate medical student's clinical performance (Sloan, Donnelly, Schwartz, & Strodel, 1995). The OSCE was used in two studies to measure student's skill performance. A typical OSCE consists of 15 to 20 stations that assess students' theoretical and practical knowledge (skill performance). Alinier et al. (2006) evaluated the effect of simulation on nursing students' skill performance, measured with the OSCE. Alinier et al. reported a statistically significant difference between the two groups on increase in scores (pretest to posttest) (independent t-test, $p < .001$) Content validity of the OSCE was done with a panel of experts, but no indication of who the panel of experts consisted of or the process used to establish content validity were reported. Previous reliability and validity information about the OSCE were included in the article, but no reliability for the current study was reported.

Schwartz, Fernandez, Kouyoumjian, Jones, and Comptom (2007) evaluated the effect of simulation training versus case-based learning in fourth year medical students. Schwartz et al. reported no statistically significant difference between the two groups (MANOVA; Hotelling's T^2 [3, 98] = .053, p = .164). Schwartz et al. included information in the article about the reliability of the OSCE (Cronbach's alpha .556), but no information regarding validity. The researchers also included information about inter-rater reliability since the OSCE practical stations are evaluated by an observer rating the student's skill performance on a check-list. Alinier et al. did not assess for inter-rater

reliability, but the principle investigators did train the OSCE examiners to ensure consistency in marking. To ensure accuracy of the ratings, inter-rater reliability of the scores for the OSCE needed to be assessed.

Simulation versus the control group. Ackermann (2009) and Alinier et al. (2006) compared simulation versus traditional lecture-only and showed an increase in skill performance, while Morgan et al. (2002), Schwartz et al. (2007), and Wenk et al. (2009) compared simulation versus video-based learning, case-based learning, and problem-based discussion respectively and showed no difference in skill performance between the groups. The video-based learning experiences consisted of a videotape showing a faculty member appropriately managing a simulation scenario. The videotape was designed to be paused at appropriate intervals to allow for group discussion (Morgan et al., 2002).

Case-based learning consisted of students being presented with a vignette describing a patient with classic signs of Acute Coronary Syndrome. Students worked in a group to determine paper history taking, workup, management, and disposition of the patient. After the discussion of the case students received ACLS protocols for managing a patient in V Tach and V Fib with a cardiac monitor and rhythm generator (Schwartz et al., 2007). Problem-based discussion consisted of students discussing how to manage a patient that required rapid sequence induction (anesthesia) (Wenk et al., 2009). The similarity between the control interventions (video based learning, case based learning, and problem based discussion) and the human patient simulator educational experience may explain why there was no difference among the two groups.

Wenk et al. also evaluated the effects of simulation on confidence and did report a significant difference in the confidence levels of medical students' educated using simulation versus problem-based discussion (previously discussed). An interesting point made by Wenk et al. is that if simulation training increases students' self-confidence, but does not increase skill performance, simulation actually leads to an undesirable effect in that students overrate their performance ability. Further research is needed to determine if high-fidelity or medium-fidelity simulation offers advantages over low-fidelity simulation, such as video-based learning, case-based learning, or problem-based discussion.

Evaluation of skill performance by other methods. There were four studies that evaluated the impact of two different educational interventions on skill performance and did not find any statistical significant differences between the two groups (Becker, Rose, Berg, Park, & Shatzer, 2006; Birch et al., 2007; Knudson & Sisley, 2000; Radhakrishnan, Roche, & Cunningham, 2007). All of these studies compared two different types of educational interventions. Birch et al. (2007) compared the skill performance of obstetric teams in their ability to provide care to a patient (simulated) having a post partum hemorrhage. Group skill performance was measured on an OSCE. The uniqueness of this study is that the researchers compared three different educational experiences, lecture-based teaching, simulation-based teaching, and a combination of lecture and simulation. The researchers did not find any statistically significant difference among the three groups (ANOVA, $p = .086$). This lack of statistical significance may have been due to the small sample size ($n = 6$ groups, 2 groups per intervention). The results of the study are interesting as the combination of lecture and

simulation group increased their OSCE score by 98 points between the pretest and posttest compared to the simulation group who improved by 74 points and the lecture group who improved by 75 points.

Three of the studies in which researchers reported no differences between the two groups had major methodological or statistical concerns, making the reported results of the studies questionable. Radhakrishnan et al. compared a group of nursing students who received the traditional 320 hour internship against a group who received this traditional internship plus simulation practice with a complex two-patient assignment. The instrument used to measure skill performance was the clinical simulation evaluation instrument, which had a score from 0 to 68 points for each individual student. These are interval data. These data were changed into categorical data and all students scores added together and Chi-Square analysis done to evaluate for differences between the groups. The study had a very small sample size with n = 12 and six students in the control group and six students in the experimental group.

Knudson and Sisley (2000) compared the posttest results between medical residents who were trained on an ultrasound simulator versus the traditional human models approach using repeated measures ANOVA. Knudson and Sisley had a statistically significant difference on the pretest between the two groups ($p = .01$). This means that the two groups were not homogeneous and violates one of the assumptions for repeated measures ANOVA (Munro, 2005).

Becker et al. (2006) compared the use of standardized patients with the usual method of instruction in an undergraduate nursing course on student's therapeutic communication skills. The student's therapeutic communication skills were measured by

the standardized patient using a post-encounter checklist that was developed by the researchers. No statistically significant difference between the two groups was identified ($p = 0.943$). The researchers analyzed the differences between pretest and posttest scores of the control and experimental group using multiple t-tests. No reliability or validity of the checklist was reported by the researchers. In the discussion section of the report, the researchers mentioned that the inability to detect a difference between the two groups may have been due to a lack of variability of the data and low number of items on the scale.

Summary of skill performance literature. The results of the literature review are confusing since some studies found statistically significant differences between students who received simulation education compared to groups who did not, while other studies did not find statistically significant differences. The proposed study is designed to investigate the effect of medium-fidelity simulation versus low-fidelity simulation (pencil/paper case study) on the measure of skill performance. The researcher intends to improve on previous studies by adding more stringent controls and assessing reliability and validity of the Objective Structured Clinical Examination (OSCE).

Summary and Gaps in the Literature

Simulation is a current up and coming topic in nursing education and as the current literature review has shown there are some concerns about the effects of simulation education on nursing knowledge, self-confidence, and skill performance. The nursing literature is inconclusive as to whether or not simulation has a higher impact on knowledge, self-confidence, or skill performance than other educational learning experiences.

Research studies that evaluated the simulation learning experience on the effect of knowledge were inconclusive. The literature supports that an educational learning experience will result in an increase in knowledge between the pretest and posttest scores, but only two studies reported a statistically significant difference between students who received simulation education and students who did not (Ackermann, 2009; Brannan, White & Bezanson, 2008). The studies that did not find a significant difference did not report information on the reliability and validity of the instrument used to measure knowledge. The nonsignificant results may have been due to the inability of the instrument to detect a difference between the two groups.

High-fidelity and medium-fidelity simulation compared to low-fidelity simulation is supported by the literature to have a positive effect on student's self-confidence. Four studies reported a statistically significant difference in student's self-confidence when educated using a high-fidelity or medium fidelity simulation when compared to a low-fidelity simulation (Butler, Veltre, & Brady, 2009; Jeffries & Rizzolo, 2006; Marshall et al., 2001; Wenk et al., 2009). The two studies that did not find a statistically significant difference may be because of a lack of sensitivity of the instrument to measure the students' self-confidence level (Brannan et al., 2008; Alinier et al., 2006).

High-fidelity simulation versus traditional-lecture education showed an increase in skill performance (Ackermann, 2009; & Alinier et al., 2006). High-fidelity and medium-fidelity simulation compared to low-fidelity simulation (video-based learning, case-based learning, and problem-based discussion) showed no difference in skill performance between the groups (Morgan et al., 2002; Schwartz et al., 2007; Wenk et al., 2009). High-fidelity or medium-fidelity simulation should result in a higher level of skill

performance than low-fidelity simulation as the student is making more neuronal connections and using the entire brain and not just the back or front of the brain. In this study, the researcher explored the effects of a medium-fidelity simulation versus a low-fidelity simulation (paper/pencil case study) experience on pediatric nursing students' knowledge, self-confidence, and skill performance.

Chapter III

Methods

The purpose of this study was to examine the effect of two educational interventions on measures of knowledge, self-confidence, and skill performance in junior level BSN nursing students. This chapter will detail the methodology relevant to this study.

Study Design

This study evaluated the efficacy of two different learning strategies that were used within the context of students' clinical experiences. The ideal study design for this research would be an experimental research design with randomization of all students into one of three groups and for each individual student to have the same clinical experience. The three groups would consist of a control group (no educational intervention), low-fidelity simulation group, and medium-fidelity simulation group. Previous research studies support that both the low-fidelity simulation and medium fidelity simulation resulted in a statistically significant increase in students' knowledge, self-confidence, and skill performance over no educational intervention, so this study will not include a control group and will just compare the two simulation experiences. One of the major threats to internal validity of the previous research studies was diffusion of treatment. Randomly assigning students into one of the two groups will not control for this threat as students in the same clinical group may be in different educational intervention groups which would increase the risk for diffusion of treatment.

Threats to Internal Validity

Diffusion of treatment. Designing the study so that all students within a particular clinical group have the same learning experience will help control for diffusion of treatment, but it does not reduce the challenge of setting up appropriate comparison groups. This is a major challenge in nursing education where attempts are made to provide students with roughly equivalent clinical experiences while addressing the challenges of having to use more than one clinical facility and at times to modify the clinical experiences to accommodate the numbers of students in a particular course in a given quarter. As the most reasonable compromise, a nonequivalent control group pretest posttest design will be used to examine and compare the effects of the two educational interventions: medium-fidelity simulation and low-fidelity simulation (paper/pencil case study).

Learning strategies for this course prior to the research study included lecture with some case scenarios discussed during clinical post-conference. In this research study, students had either a medium-fidelity simulation or low-fidelity simulation that expanded on the case scenarios that were already part of the pediatric nursing course. The addition of the simulation activities should result in an increase in the students' knowledge, self-confidence, and skill performance. The low-fidelity simulation (pencil/paper case study) will introduce the students to a patient who is in distress and have the students, working in groups, write out what they would assess, what their interventions would be, and how to communicate assessment findings to patient, family, and respiratory therapist. After working through the low-fidelity simulation students were debriefed by the nurse researcher.

The medium fidelity simulation presented the students with a patient in distress, and working again in groups, had the students perform the assessment and interventions on the patient simulator. Students in this group were assigned to different roles, so students in the nurse role will be communicating their findings to the students assigned to the family role and to a nurse educator playing the role of the respiratory therapist. Students will be more actively involved in the learning process for the medium-fidelity simulation than for the low-fidelity simulation (pencil/paper case study). This teaching strategy is expected to result in building more neuronal connections which is hypothesized to result in a higher level of knowledge, self-confidence, and skill performance.

Table 1

Clinical Groups and Patterns of Clinical Experience

Week	Groups										Lecture Topic
	1	2	3	4	5	6	7	8	9	10	
1	O	O	O	O	O	O	O	O	O	O	Growth and Development
2	H1	H1	H2	H2	H1	H1	H1	S	S	S	Respiratory
3	H1	H1	H2	H2	H1	H1	H1	S	S	S	Immunizations
4	H1	H1	H2	H2	H1	H1	H1	S	S	S	Cardiac
5	H1	H1	H2	H2	H1	H1	H1	S	S	S	Gastrointestinal
6	H1	H1	H2	H2	S	S	S	H1	H1	H1	Genitourinary
7	H1	H1	H2	H2	S	S	S	H1	H1	H1	Endocrine
8	H1	H1	H2	H2	S	S	S	H1	H1	H1	Musculoskeletal Neuromuscular
9	C	C	C	C	S	S	S	H1	H1	H1	Abuse/Social Political
10	C	C	C	C	S	S	S	H1	H1	H1	Hematology and Oncology
Group:	LF	MF	MF	LF	MF	LF	MF	LF	MF	LF	

Note. O = Orientation, no hands on clinical experience; H1 = Dayton's Children; H2 = Cincinnati's Children; S = Schools; C = Community; LF = Low-Fidelity Simulation; MF = Medium-Fidelity Simulation

Since the learning strategies need to be introduced in separate clinical groups to control for diffusion, the second major challenge is to identify comparison groups that are as equivalent as possible. This is critical to reduce the possibility that outcomes are due primarily to the nature of the clinical experience without respect to the learning strategy being evaluated. In this course there are ten clinical groups. Each clinical group has experience in an acute care setting and within the community (see Table 1).

Among the ten clinical groups, there were some differences in setting and format for the clinical experience. Therefore, the ten groups were divided into subsets based on the similarity of the setting and format (see Table 2). Within the subsets, they were randomly assigned so that half of the groups received low-fidelity simulation and the other half received medium-fidelity simulation.

Table 2

Setting and Format of Clinical Experience

Hospital Setting	Format of Clinical		
	Hospital/Community	Hospital/Schools	Schools/Hospital
Dayton's Children	Group 1 & 2	Group 5, 6, & 7	Group 8, 9, & 10
Cincinnati's Children	Group 3 & 4		

Figure 2 diagrams the research design for this study. Data on knowledge and skill performance were collected at O_1 for both groups during the first week of the quarter. During the second week of the hospital clinical experience (week 3 or 8 of the quarter) all groups received the educational learning experience (X_1 or X_2) and post intervention data were collected on self-confidence (O_2). During the third week of the hospital clinical experience (week 4 or 8 of the quarter), post intervention data on knowledge and skill performance were collected on both groups (O_3).

	Week 1	Week 3 or 7	Week 4 or 8
Group 1 (Low-Fidelity Simulation) (Week 3 – Groups 1, 4, 6) (Week 7 – Groups 8, 10)	O_1	X_1, O_2	O_3
Group 2 (Medium-Fidelity Simulation) (Week 3 – Groups 2, 3, 5, 7) (Week 7 – Group 9)	O_1	X_2, O_2	O_3

Figure 2. Research design

Key: O_1 = Pretest (Knowledge and Skill Performance); X_1 = Low-Fidelity Simulation; X_2 = Medium-Fidelity Simulation; O_2 = Observation for Self-Confidence; O_3 = Posttest Observation for Knowledge and Skill Performance

During the clinical experience all students will provide care to a variety of hospitalized children which may result in a difference in the clinical experience that each individual student receives. By assigning groups of students who have the potential for similar clinical experiences evenly between the control and experimental group, this should result in the groups having similar clinical experiences. Demographic data on the types of patients cared for and skills performed during the clinical experience will be collected and analyzed for homogeneity.

Maturation. The threat of maturation is observed when respondents have grown older, wiser, stronger, or more experienced between the pretest and posttest (Cook & Campbell, 1979). To decrease the threat of maturation in this study, the simulation experiences and post-test evaluation were the same for all groups relative to their hospital clinical experience. For all ten clinical groups, the educational interventions occurred during the second week of the hospital experience and the post-intervention evaluation occurred during the third week of the hospital experience. Groups 8 through 10 did not receive the educational experience and evaluation until the seventh and eighth weeks of the quarter. Since these three groups have been in the schools prior to the hospital

experience, the school experience should not increase their ability to care for children in an acute care setting (increase in maturation). This group of students though may have an increase in self-confidence as they have been working with pediatric patients for five weeks prior to the educational intervention. The self-confidence data for Groups 8 through 10 was compared to Groups 1 through 7 to determine if there was a significant difference between these groups because of the differences in clinical time. There was no significant difference noted between the two groups.

Selection. The threat of selection is an effect due to the possible difference between the students in the control groups when compared to students in the experimental group (Cook & Campbell, 1979). Demographic data were collected on all students and a statistical analysis performed to determine if the two groups of students are homogeneous. The two groups were also compared at O1 to determine if there were any pre differences between the two groups. If the groups were determined to be statistically different, regression analysis instead of repeated measures ANOVA would be used to analyze the data. There was no statistically significant difference between the two groups of students, so repeated measures ANOVA was used to analyze the data. The individual clinical group's data were also reviewed for any obvious visible differences between the clinical groups that may have affected the results of the study; however, none were identified.

Testing and Instrumentation. The threat to internal validity of testing is an effect that occurs when students are exposed to the same instrument multiple times and become familiar with the test (Cook & Campbell, 1979). The initial plan for this study was to administer a pretest and posttest, but two different tests would be used to reduce

the threat to internal validity of testing. The tests covered the same content areas but consisted of different questions. The two tests were not identical, so there was an instrumentation threat to internal validity. The threat of instrumentation occurs when there is a change in the way the instrument is measured between the pretest and posttest (Cook & Campbell, 1979). Because the researcher after further review had decided that the threat to internal validity of instrumentation was more of a risk than the threat of testing, a decision was made by the researcher prior to conducting the full study (after the pilot study had been completed) to use the same 15 question knowledge test for the pretest and posttest.

History. The history threat is observed when there is an event which takes place between the pre and posttest that is not due to the treatment (Cook & Campbell, 1979). History was evaluated by assessing for any patterns or events that impacted the entire class during the quarter; no such events were identified.

Sample and Setting

The population of interest for this research study is students in a Bachelor of Science in nursing education program. A convenience sample of junior nursing students in a pediatric nursing course was used for this study. The sample plan was to recruit all nursing students enrolled in a pediatric nursing course during Winter quarter of 2011 at a Midwestern University. There are approximately 80 to 110 students enrolled in the pediatric nursing course twice a year. Students enrolled in the pediatric nursing course were admitted to the College of Nursing and Health and had successfully completed a physical assessment course, fundamentals of nursing course, and a medical-surgical

nursing course. In all three of these previous nursing courses, students were exposed to the medium-fidelity patient simulator.

Each student participated in a total of 200 clinical hours prior to the beginning of Winter quarter. Forty hours were spent during the fundamentals course on a medical-surgical unit providing basic care to patients (vital signs, baths, but limited medication administration). The next quarter, students spent eighty hours on a medical/surgical unit. During the medical/surgical experience, all students administered medications. Also during this clinical experience, all students observed an intravenous infusion but very few students had the opportunity to administer an intravenous infusion or change the rate. During the next quarter, prior to winter quarter, students spent eighty hours in a long-term care facility. Most of the students did have exposure to medication administration in the long-term care facility but did not verify patient identification using the name band as residents of the long-term care facility do not wear name bands. Between Fall and Winter Quarter there is a six week break so students had at least four months since the last time they verified a patient's identification using the patient name band.

Recruitment procedure. Prior to the pretest observation, the principle investigator explained the research study to the students in the pediatric nursing course. The principal investigator provided the students with the Cover Letter (see Appendix A). After providing the students with the cover letter the principal investigator explained to the students that all students as part of the clinical requirements for the course would be required to participate in one of the two educational interventions and the pretest and posttest observations. The clinical component of the course is pass/fail and if students are unable to participate in the educational intervention or pretest or posttest observation

due to an excused absence, students were given a written make-up assignment as is the policy in the course.

Inclusion and exclusion criteria. All students in the pediatric nursing course were included in the study. The students who missed a portion of the study, the pretest, intervention, or posttest were excluded from the study.

Determination of sample size/power analysis. A power analysis for repeated measures ANOVA and independent t-test was calculated using the computer-based G-power program (Faul, Erdfelder, Lang, & Buchner, 2007). A medium effect was chosen based on research that was conducted by Alinier et al. (2006). Alinier et al. (2006) research is the most similar research to this study as the researchers looked at the differences in skill performance between a group of students who received simulation training and a group of students who did not and skill performance was measured with the OSCE. This research used the t-test for significant differences between two independent groups and resulted in an effect size of 0.66. Cohen (1988) states that this is a medium effect size for a t-test on means. Research question 2 compares mean posttest scores between two groups of students on self-confidence. An independent t-test was used to analyze the differences between the two group means. With the t-test, the difference between two independent means (two groups), for a two-tailed test with an effect size of 0.5, alpha at 0.05, and a power of 0.80, the estimated total sample size is 128 with 64 students per group.

Research questions 1 and 3 compared mean pretest and posttest scores between two groups of students on knowledge and skill performance. Repeated measures ANOVA was used to analyze the data. The medium effect size for the ANOVA (F test)

is 0.25 (Cohen, 1988). With the F tests, ANOVA, repeated measures, within-between interaction, effect size of 0.25, alpha at 0.05, power at 0.80, 2 groups, and 2 measurements, the estimated total sample size is 34, with 17 students per group.

Experimental Intervention: Medium-Fidelity Simulation Education

Students in the medium-fidelity simulation group participated in one simulation experience in groups of three or four (see Appendix B for Simulation Design). Each simulation experience lasted 30 minutes followed by 20 minutes for a planned debriefing experience for the group. The experience focused on a patient in respiratory distress who students assessed and then provided appropriate nursing interventions to relieve the patient's respiratory distress. At the end of each simulation experience students participated in a planned debriefing session that lasted for 20 minutes. The student who was the "recorder" during the simulation led the debriefing session with the assistance of the nursing faculty member. The information that was obtained during the simulation experience and debriefing session were part of the educational experience only and were not analyzed by the researcher.

Comparison Group: Low-fidelity simulation (paper/pencil case study) education.

Students in the comparison group worked through a low-fidelity simulation with paper and pencil that was similar to the medium fidelity simulation experience. The key differences between the low fidelity simulation and medium fidelity simulation are the implementation of nursing interventions. In the medium fidelity simulation students actively performed the nursing interventions and in the low-fidelity simulation (paper/pencil case study) students only discussed what they would do as they did not perform the interventions (see Appendix C for Case Study Questions). Students, working

in groups of three or four, had 30 minutes to complete the case study. At the end of the 30 minutes, a faculty member led a debriefing session that lasted 20 minutes. The case study debriefing sessions covered similar content to the medium fidelity simulation sessions. Students in the low fidelity simulation did discuss how to perform the interventions, but did not actively perform or handle any of the necessary equipment to perform the interventions.

Instruments

Four instruments will be administered to the study participants. These instruments included: A demographic questionnaire, knowledge test, self-confidence in learning using simulations scale (Jeffries & Rizzolo, 2006), and Objective Structured Clinical Examination (OSCE).

Demographic and clinical experience data. Demographic data were collected during the pretest and posttest observations and recorded on forms developed by the researcher (see Appendices D and E). During the pretest, information was collected regarding the participant's age, gender, and previous clinical experiences. During the posttest additional information regarding the current clinical experience was collected. The demographic data were collected on all students and a statistical analysis performed to determine if the two groups (medium-fidelity and low-fidelity simulation) of students were homogeneous. No statistically significant difference was noted between the two groups, so they were homogeneous.

Knowledge test. All participants completed a 15-item multiple choice knowledge test, related to caring for pediatric patients and caring for a pediatric patient in respiratory distress during the pretest and posttest observations. Initially two parallel forms of the test had been designed and were used in the pilot study. Prior to beginning

data collection for the main study, the researcher made a decision to just use one test for both the pretest and posttest, to reduce the internal validity threat of instrumentation. The initial parallel tests and the final knowledge test included comprehension, application, and analysis level questions. Questions for the instruments were obtained from the test bank that accompanies *Wong's Essentials of Pediatric Nursing* (Hockenberry & Wilson, 2009). This is the required textbook for the pediatric nursing course. A copy of the knowledge tests have not been included due to the questions being obtained from the test bank. Content validity of the instruments was established by three experienced faculty members with a background in pediatric nursing (Burns & Grove, 2009). The instruments were analyzed for reliability by assessing for internal consistency utilizing Cronbach's alpha. A Cronbach's alpha coefficient value of > 0.80 means that the knowledge instrument has a desired level of internal consistency and is a reliable instrument.

Self-confidence in learning. All participants completed the self-confidence in learning instrument during the posttest observation. The self-confidence in learning is an 8-item instrument that measures how confident students feel about the skills they practice when participating in the patient simulation experience. Items are measured on a five-point Likert scale (Jeffries & Rizzolo, 2006), and scores range from 8 to 40. In the original study using the instrument, content validity was established by a group of nine clinical experts (Jeffries & Rizzolo, 2006). In the initial research with 403 nursing students, reliability of the instrument was tested with Cronbach's alpha and was found to be 0.87 (Jeffries & Rizzolo, 2006). Since the original development of the instrument, it has been combined with the student satisfaction instrument (5 items) and is now a 13-

item instrument that measures both student satisfaction and self-confidence in learning. Permission to use the instrument in this study was obtained from the National League for Nursing (See Appendix F). The instrument was modified slightly to fit the content area of pediatric nursing (instead of medical surgical nursing) and only the original 8-items that measure self-confidence in learning was used (See Appendix G). The eighth item on the instrument, "It is the instructor's responsibility to tell me" is a negatively worded item, so was reversed coded prior to data analysis. After the data were collected, the instrument was assessed for internal consistency. A Cronbach's alpha coefficient value of > 0.80 indicates that the self-confidence in learning instrument has a high degree of internal consistency and is a reliable instrument.

Objective structured clinical examination (OSCE). The OSCE was first used in medicine in 1975 to assess clinical competency at the bedside of first year medical students (Harden & Gleeson, 1979). The OSCE is an instrument that provides an objective evaluation of a student's ability to perform clinical skills. The OSCE consists of multiple stations where students are required to demonstrate clinical competence. Students are allocated anywhere from 4 to 15 minutes to complete a station (Harden, 1990). Sloan et al. (1995) conducted research to determine the reliability and validity of the OSCE in the evaluation of surgical residents. During the research study, a comprehensive 38-station OSCE was administered to 56 surgical residents who ranged from interns (new residents) to senior residents (4^{th} through 6^{th} years). The reliability of the OSCE was measured by the Cronbach's alpha which was 0.91, which indicates a high internal consistency of an instrument. Construct validity was assessed by splitting the residents into three groups based on years of experience: incoming interns (year 1),

junior residents (year 2 and 3), and senior residents (year 4, 5, and 6). Performance varied significantly based on level of training ($F= 53.876$, $df = 2, 53$; $p < 0.0001$) with the senior residents performing the best and the interns the worst (Student-Newman Keuls post hoc test) (Sloan et al., 1995). Construct validity was further supported by assessing the correlation between the level of training and OSCE percentage score. The Pearson correlation was 0.80 (Sloan et al., 1995).

All of these data support that the OSCE is a reliable and valid instrument when used with medical students and residents, but there are little data to support the reliability and validity of the OSCE when used with nursing students. The only study to date that has used the OSCE with nursing students was conducted by Alinier et al., (2006). In their study, the researchers discussed the previous work done by Sloan et al. (1995), but did not report the reliability and only briefly mentioned the validity of the OSCE. Alinier et al. (2006) specifically stated "a panel of educators was involved in the validation of the 15 stations for content and accuracy" (p. 364), but there was no discussion of who made up the panel or how they determined validity of the OSCE.

In the research study, all students completed the OSCE as part of the pretest and posttest observations. The original OSCE, used for the pilot study consisted of 12 five-minute stations (see Appendix H) with a one-minute gap to allow students to rotate to the next station. Due to time constraints and limited human observers, the OSCE used for the main study consisted of 9 seven-minute stations (see Appendix I) with a one-minute gap to allow students to rotate to the next station. The theoretical stations required students to answer multiple questions on the topic with either fill in the blank or multiple choice questions. Answers were scored with one point for correct answers and zero

points for incorrect answers. The practical stations consisted of a skills checklist developed by the researcher that identified the different steps in the performance of the skill. Students received one point for correctly performing each step and zero points if the step was not performed or performed incorrectly. Information used to develop the station checklists were obtained from *Fundamentals of Nursing* (Potter & Perry, 2009) and *Wong's Essentials of Pediatric Nursing* (Hockenberry & Wilson, 2009). These are current and previously required textbooks for the pediatric nursing course. The practical stations were scored by human observers. All stations except one was scored by the same human observer for all participants both pretest and posttest. The station that had two human observers was assessed for inter rater reliability utilizing Cronbach's alpha. A Cronbach's alpha > .80 indicates an acceptable inter rater reliability between the two observers.

Students for the pilot test received a total maximum score of 197 points for the 12 stations. Students for the main study received a maximum total score for the Objective Structured Clinical Examination Instrument of 131 points for the 9 stations. Validity of the OSCE and the checklists was determined prior to data collection. Content validity was established by three experienced faculty members with a background in pediatric nursing (Burns & Grove, 2009). After data collection was completed, the instrument was assessed for internal consistency. A Cronbach's alpha coefficient value of > 0.80 indicates that the OSCE has a high degree of internal consistency and is a reliable instrument.

Pilot Study

Prior to conducting the main research study, a pilot study was conducted to determine the feasibility of the medium-fidelity and low-fidelity simulations, the knowledge test, and the OSCE. The educational simulations being used for this study had not been previously used in this course. The pilot study was conducted with a group of junior nursing students enrolled in an outreach BSN program that is located an hour from main campus. The pilot study was conducted to determine if there were any problems with the educational interventions and to gather some baseline statistics on the knowledge tests and OSCE.

Recruitment procedure. Following the same proposed recruitment procedure as the proposed study; all students as part of the clinical requirements for the course were required to participate in one of the two educational interventions and the posttest observations. All students were provided with a copy of the cover letter (See Appendix A) and the research study was explained to the students by the principal investigator.

Procedure. During the eight week of the quarter, one Monday clinical group participated in the low-fidelity simulation. The other Monday clinical group and Thursday clinical group participated in the medium-fidelity simulation. During the simulation experiences the principal investigator made note of any problems when conducting the simulation experiences. No problems or issues arose during either the low-fidelity or medium-fidelity simulation experience.

During the tenth week of the quarter, the posttest observation was conducted and all students who were present completed the Demographics questionnaires, the Pretest and Posttest Knowledge Instruments, the Self-Confidence in Learning Instrument, and

the Objective Structured Clinical Examination (OSCE). Having never previously administered the OSCE, the time to complete the evaluation of the students on this instrument took longer than had been anticipated. This resulted in not all students completing all of the instruments for the study, with some students completing the OSCE while other students completed the Knowledge Tests. The Self-Confidence in Learning instrument was completed by all students who participated in the simulation experiences. Based on the amount of time required to complete the OSCE, this instrument was modified prior to the main study to allow for all students to complete this evaluation instrument in the time allotted and with the limited number of human observers.

Data analysis. The knowledge, self-confidence, and skill performance data that were collected during the pilot study were analyzed for reliability of the instruments using Cronbach's alpha. The difference between the two groups on knowledge, self-confidence, and skill performance was analyzed using differences between the two group means (independent sample t-tests). The total number of students in each group for each dependent variable did vary since not all students were able to complete all of the instruments due to time constraints.

Procedure for Primary Study

During the first week of the quarter on their assigned clinical day, all students enrolled in the pediatric nursing course completed the demographic instrument, pre-test knowledge instrument, and Objective Structured Clinical Examination (OSCE). During the second week of the hospital clinical experience, all students received the educational learning experience, low-fidelity simulation (paper/pencil case study) or medium-fidelity simulation, and post-intervention data were collected on self-confidence. The initial plan was for 3 to 4 students to participate in each simulation experience. This was true for all

groups except one low-fidelity simulation group that only had five students at clinical on the day of the simulation experience. Instead of having two or three students in a group, the decision was made to have the five students complete the low-fidelity simulation together as one group. All other groups had no more than four students participating in the simulation experience at a time. During the third week of the hospital experience, all students completed the demographic instrument, post-test knowledge instrument, and the OSCE.

Protection of Human Subjects

Human subject approval for this study was obtained from the Institutional Review Board (IRB) at Wright State University and the IRB at Case Western Reserve University. Confidentiality of participant responses on the study instruments were maintained throughout the study. No names appeared on any of the data collection forms only the evaluation identification number (EID). Each form in the individual student's set initially had a name on a post-it note so the evaluation forms were given to the correct student. The student or human observer removed the post-it note when the student received the form. No names were permanently attached to the evaluation form. All data (paper forms and disks) were kept in a locked file cabinet in a private office and stored in a security enabled and protected computer files. Data were only available to the principal investigator and any research associate.

Data Management

After all data were collected on the paper instruments, the data were entered into SPSS. To protect the validity of the data and decrease the potential for random and systematic error due to data entry errors, all data entered into SPSS were double checked

for accuracy. Means and standard deviations were calculated for interval data and compared to normal expected values for that variable. Any data that were outside the expected variation was inspected for errors in coding or data entry (Burns & Grove, 2009).

Summary

A nonequivalent design was used to examine and compare the effects of medium fidelity simulation and low-fidelity simulation (paper/pencil case study) on measures of knowledge, self-confidence, and skill performance. The sample consisted of junior level BSN nursing students in a pediatric nursing course and the total estimated sample size needed for adequate power was 128 students. Students were assigned to the low-fidelity simulation (paper/pencil case study) or medium-fidelity simulation based on clinical assignment to prevent any possible diffusion of treatment, a threat to internal validity. The experimental intervention that was used in this study was one pediatric simulation experience that involves caring for a pediatric patient in respiratory distress. The comparison group received a low-fidelity simulation similar to the medium fidelity simulation, but worked through the scenario in a paper/pencil format. The knowledge test, self-confidence in learning instrument, and OSCE were used to measure both baseline and outcome levels of knowledge, self-confidence, and skill performance.

Chapter IV

Results

In this study, the researcher examined the effect of simulation on student's knowledge, self-confidence, and skill performance. The purpose of this chapter is to describe the characteristics of the sample for both the pilot study and the main study. Findings are presented to answer the research question: Do junior BSN pediatric nursing students who receive a medium-fidelity simulation learning experience have a higher level of (a) knowledge, (b) self-confidence, and (c) skill performance than nursing students who receive a low-fidelity simulation (paper/pencil case study)?

Sample Characteristics for Pilot

The initial pilot sample consisted of twenty-two students, with seven students participating in the low-fidelity simulation and fourteen students participating in the medium fidelity simulation. The purpose of the pilot study was to examine the procedure and provide an opportunity to refine both procedures and instruments as needed. One student was absent on the day of the simulation experience so was excluded from the data analysis and description of the study. Of the total sample, 38% (n=8) were 22 years of age or younger, 29% (n = 6) were between the ages of 23 to 30 years, and 33% (n = 7) were over the age of 31 years; 67% (n=14) were female and 33% (n = 7) were male. The demographic data collected during the pretest and posttest were not able to be analyzed to determine if the two groups (medium-fidelity and low-fidelity simulation) were homogeneous using the Pearson Chi-Square. To use the Pearson Chi-Square no more than 20% of the cells may contain less than five students and the small sample size resulted in most of the cells having fewer than five students. The frequencies of the

demographic data were visually reviewed by the researcher and the two groups did not appear to be homogeneous. In the medium fidelity simulation group, 29% of the students were male and in the low-fidelity simulation group, 42% of the students were male. There also visually appeared to be a consistent difference between the two groups with the current clinical experience in that approximately half of the students in the medium-fidelity simulation had experience with IVs, face mask, respiratory treatment, and caring for an asthma patient where only one out of seven students in the low-fidelity group had these experiences.

Psychometric Tests of Pilot Study Instruments

The pilot study data were collected during the tenth week of the quarter during students' scheduled class time. The plan was for 1/3 of the students to be evaluated on the Objective Structured Clinical Examination (OSCE) every hour. Once a group had completed the OSCE they would then complete the knowledge tests and self-confidence in learning instrument. Having never previously administered the OSCE, the time to complete the evaluation of the students on this instrument took longer than had been anticipated. This resulted in not all students completing all of the instruments for the study as the students were only available (due to schedule conflicts) during the assigned class time. Some students completed only the OSCE, some completed only the knowledge tests and others completed both the OSCE and knowledge tests. The Self-Confidence in Learning instrument was completed by all students who participated in the simulation experience. The knowledge instrument, self-confidence in learning, and overall OSCE score were assessed for internal consistency, using Cronbach's alpha (see Table 3).

Table 3

Reliability Coefficients for Pilot Study Instruments

Variable	n	Total Items	Possible Range of Scores	Cronbach's alpha
Knowledge – Combined Test	19	30	0 to 30	.62
Modified Knowledge Test	19	15	0 to 15	.31
Self-Confidence in Learning	21	8	8 to 40	.77
Objective Structured Clinical Examination	13	197	0 to 197	.84
Modified OSCE	13	137	0 to 137	.84

Knowledge instrument. The initial knowledge instruments consisted of different tests for the pretest and posttest that covered similar content areas. There were a total of 15-items on each instrument. As the pilot study was conducted to assess the internal reliability of the knowledge instruments, both the pretest and posttest knowledge instruments were given to the students, resulting in a total of 30 items. The total score for both knowledge instruments was combined when analyzing the data for the pilot study. The combined knowledge test had low internal consistency (Cronbach's alpha = .62).

Modified knowledge instrument for full study. The initial plan for the full study was to use two similar, but not identical, knowledge tests. This was planned to reduce the threat to internal validity of testing. After further review by the researcher, the potential for decreasing the validity and reliability of the instruments was considered to be of more concern than the design threat of instrumentation. Based on these threats, the same test was used for the pretest and posttest of knowledge. The ideal situation for the full study would have been to use all 30 items for the knowledge assessment. Due to time constraints this was not possible and a 15-item test was developed from the previous pretest and posttest questions. The 15-item knowledge instrument was designed to

include multiple concepts. These concepts focused on caring for pediatric patients in the areas of communication, assessment, nursing interventions, and safety. These are the same areas that were covered by the Objective Structured Clinical Examination. The modified knowledge test had a Cronbach's alpha = .31 which indicates that the modified knowledge instrument did not achieve an acceptable level of internal consistency. This finding regarding the modified knowledge test was a concern and is discussed in detail in the context of the discussion of the study results. Cronbach's alpha may not have been the most appropriate measure of reliability based on the construction of the revised knowledge test. Ideally prior to conducting the full study, the revised knowledge instrument should have been tested on a large group of students to examine the psychometric properties of each item. Item analysis would have helped to determine the number of questions and which questions were statistically the most appropriate.

Self-confidence in learning. The Self-Confidence in Learning instrument had an adequate level of reliability with a Cronbach's alpha = .77.

Objective structured clinical examination (skill performance). The objective structured clinical examination had a high rate of reliability (Cronbach's alpha = .835). The OSCE for the pilot study was evaluated by four different nursing faculty with each faculty member evaluating at least two different stations. The allotted time to complete the OSCE was an hour for each set of six students. The actual time required to complete the evaluation was almost two hours for the first set of six students and an hour and half for the second set seven students. The third set of seven students, due to time constraints, did not participate in the OSCE.

Modified OSCE instrument for full study. Based on the amount of time required to complete the OSCE, this instrument was modified prior to the main study to allow for all students to be able to complete the evaluation instrument in the allotted time with the limited number of observers who were available to complete the evaluation. Each of the 12 stations on the original OSCE was evaluated to determine if there were any repetitious skills or if there were any stations that could be converted to a theoretical station. Based on the data, it was determined that Station 1, vital sign assessment, was included in Station 5. Station 3, though not included in any other station, had all students in the pilot study scoring almost perfect on this station. Station 7, the expiratory peak flow meter was identified to be a station that could easily be converted to a theoretical station and help decrease the number of stations that required a human observer. This resulted in 2 stations being deleted from the OSCE and one station modified and added as theoretical questions to Station 8, a station that was already a theoretical station. Reliability for the modified instrument (with all three stations deleted) was at a desired level (Cronbach's alpha = .84) and was slightly higher than the original reliability level.

Pilot Study Research Questions

Research question. Do junior BSN pediatric nursing students who receive a medium-fidelity simulation learning experience have a higher level of (a) knowledge, (b) self-confidence, and (c) skill performance than nursing students who receive a low-fidelity simulation (paper/pencil case study)?

Assumptions for independent sample t-test. The assumptions of the independent sample t-test are: the independent variable is categorical and contains two levels (assumption of independence); the distribution of the dependent variable is normal;

variances of the dependent variable for the two groups are similar (homogeneity of variance) (Munro, 2005). The assumptions of the t-test for knowledge, self-confidence, and skill performance were all met. Each individual student only contributed one score to one group for each of the dependent variables meeting the assumption of independence. Frequency distributions of the dependent variables, knowledge, self-confidence, and skill performance were evaluated. A bell shaped curve around the mean indicates normal distribution. Data that is skewed (value greater than ± 1.96) indicates that the dependent variable is not normally distributed and violates this assumption. The frequency distribution for knowledge (skewness = .258), self-confidence (skewness = -.875) and skill performance (skewness = -.039) were all not skewed indicating that all the dependent variables were normally distributed. The last assumption, homogeneity of variance, was met. Levene's Test of Equality of Variance was not significant for any of the dependent variables: Knowledge (p = .189), Self-Confidence (p = .322), and Skill Performance (p = .764).

Table 4

Comparison of Pilot Study Groups

Instrument	Group	Mean	Std. Deviation	n	t-test	p
Knowledge	Low-Fidelity	21.00	2.92	5	.505	.62
	Medium-Fidelity	20.08	3.64	13		
Self-Confidence	Low-Fidelity	31.71	2.56	7	.776	.45
	Medium-Fidelity	30.28	4.47	14		
Skill Performance	Low-Fidelity	95.33	13.59	6	-.564	.53
	Medium-Fidelity	99.28	11.71	7		

Note. Not all students completed all instruments due to time constraints

Statistical analysis – independent sample t-test. An independent sample t-test was conducted to investigate the difference in knowledge, self-confidence, and skill

performance. The pooled variance t-test results showed no significant difference between the two groups on any of the dependent variables: Knowledge (t = .505, df = 16, p = .620); Self-Confidence (t = .776, df = 19, p = .447), and Skill Performance (t = -.564, df = 11, p = .584) (see Table 4). The results indicate that there was not a significant difference in knowledge, self-confidence, or skill performance between the two groups.

Sample Characteristics for Study

The initial sample consisted of seventy-seven students with seventy-three students completing both the educational intervention and all study instruments during the evaluation process. The four students who did not complete the entire study either were absent on the day of the educational intervention or were absent from clinical on the day of the evaluation. These four students were excluded from the data analysis and description of the study because they did not complete all parts of the study. Of the total sample, 52% (n=38) were 22 years of age and under, 30% (n = 22) were between the ages of 23 to 30 years and 18% (n = 13) were over the age of 31 years; 84% (n=62) were female and 16% (n = 12) were male (see Table 5).

Table 5

Demographic Characteristics – Main Study Sample

Characteristic	Low-Fidelity (n = 36)	Medium-Fidelity (n = 37)	X^2	df	p
Age: (N = 73)			2.33	2	ns
22 Years and Under (n=38)	21	17			
23 to 30 Years (n=22)	11	11			
Over 31 Years (n=13)	4	9			
Gender: (N = 73)			.003	1	ns
Female (n=61)	30	31			
Male (n=12)	6	6			

The demographic data that were collected during the pretest and posttest were analyzed to determine if the two groups (medium-fidelity and low-fidelity simulation) were homogeneous. The two groups were analyzed for differences using the nonparametric test, Pearson Chi-Square. The initial data for age differences consisted of four categories, but when analyzed, 50% of the cells contained less than 5 students. To use the Pearson Chi-Square, no more than 20% of the cells can contain less than 5 students, so the last two age group categories (31 to 40 years of age and over 40 years of age) were collapsed into one category (over 31 years of age). No statistically significant difference was noted between the two groups on any of the demographic characteristics, so the two groups were homogeneous (see Table 6). Even though no statistically significant difference was noted between the two groups, the medium-fidelity simulation group did have almost twice as many students 31 years of age or older than then low-fidelity simulation group.

Table 6

Comparison of Clinical Experiences by Study Group

	Chi-Square (χ^2)	df	p
Previous Clinical Experiences			
IV	.129	1	.719
Nasal Cannula	1.730	1	.188
Face Mask	.006	1	.939
Respiratory Treatment	.010	1	.922
Pneumonia	.188	1	.665
Asthma	1.113	1	.291
Current Clinical Experiences			
IV	.117	1	.733
Nasal Cannula	1.212	1	.271
Face Mask	.160	1	.689
Respiratory Treatment	.660	1	.416
Pneumonia	.005	1	.943
Asthma	.430	1	.512

Psychometric Tests of Study Instruments

The knowledge instrument, self-confidence in learning, and overall OSCE score were assessed for internal consistency, using Cronbach's alpha (see Table 7).

Table 7.

Reliability Coefficients for the Study Instruments

Variable (n = 73)	Total Items	Possible Range of Scores	Cronbach's alpha
Knowledge			
Pretest	15	0 to 15	.21
Posttest	15	0 to 15	.38
Self-Confidence in Learning	8	8 to 40	.71
Objective Structured Clinical Examination			
Pretest	131	0 to 131	.73
Posttest	131	0 to 131	.83

Knowledge instrument. The knowledge instrument did not reach acceptable levels of reliability with the pretest Cronbach's alpha = .21 and the posttest Cronbach's alpha = .38. A high level of reliability of the instrument using Cronbach's alpha was not necessarily expected because the instrument was designed to measure multiple concepts and not just one concept and had only a total of 15 items. The concepts focused on caring for pediatric patients in the areas of communication, assessment, nursing interventions, and safety. These are the same areas that were covered by the Objective Structured Clinical Examination.

Self-confidence in learning. The Self-Confidence in Learning instrument had an adequate rate of reliability with a Cronbach's alpha = .71. The individual items on the instrument were assessed to determine if removing an item would result in a higher level of internal consistency. The internal consistency of the instrument increased to a desired

level (Cronbach's alpha = .84) when item #8 was removed. This was the item that was a negative statement about learning and was reverse coded prior to analysis.

Objective structured clinical examination (skill performance). The objective structured clinical examination had acceptable and desired levels of reliability for the pretest (Cronbach's alpha = .73) and posttest (Cronbach's alpha = .83) respectively. The OSCE was evaluated by five different nursing faculty members. All stations, except Station 9, were scored by the same faculty member for both the pretest and posttest evaluations. Station 9 was assessed for inter-rater reliability since there were two faculty members who evaluated the students during the posttest OSCE. All pretest scores for the OSCE for station 9 were evaluated by the first rater. During the first day of posttest evaluation, the second rater observed the first rater evaluating students and learned to score students in a similar manner to the first rater. During the second day of the first set of posttest evaluations both the first rater and second rater scored each student individually. This subset of scores was then assessed for interrater reliability using Pearson r Correlation because the instrument was at an interval level of measurement. The interrater reliability was acceptable since the Pearson r was greater than .80 (Pearson r = .92, n = 19). The first rater evaluated students during the first set of post evaluations (Week 4) and the second rater evaluated students during the second set of post evaluations (Week 8). This was done as the first rater had scheduling conflicts during the second set of post evaluations.

Research Question One and Three – ANCOVA versus ANOVA

When comparing groups and measuring change with pretest and posttest data, the two traditionally used statistical tests is Analysis of Covariance (ANCOVA) and repeated

measures Analysis of Variance (ANOVA) (Dimitrov & Rumrill, 2003). ANCOVA is the recommended method for analysis for pretest-posttest data. In a nonrandomized design, "ANCOVA adjusts the posttest means for differences among groups on the pretest, because such differences are likely to occur with intact groups" (Dimitrov & Rumrill, 2003, p. 161). One of the major statistical problems with using the ANCOVA is pretest differences (systemic bias) between the two groups can affect the interpretations of posttest differences (Dimitrov & Rumrill, 2003). In this study, there was not a statistically significant difference between the two groups on pretest data on knowledge scores and skill performance scores, but there was a visual difference with the low-fidelity simulation group with lower pretest scores on knowledge and the medium-fidelity simulation group with lower pretest skill performance scores. Differences in the pretest scores affect the accuracy of the statistical test, ANCOVA. Another problem with using ANCOVA for the current study is that one of the main assumptions, variances for the dependent variable are normally distributed, was violated (Levene's Test of Equality of Error Variance was significant for the Skill Performance Posttest ($p = .017$)). For these reasons, the Repeated Measures ANOVA was chosen for analysis of the differences between the two groups on knowledge and skill performance.

Research Question One Results – Knowledge

Question one hypothesis. Nursing students who receive a medium-fidelity simulation learning experience will have higher knowledge scores than students who receive the low-fidelity simulation (paper/pencil case study) learning experience.

Assumptions for repeated measures ANOVA. The assumptions for the repeated measures ANOVA are: the dependent variable is normally distributed, the variances of

the dependent variable for the two groups are similar (homogeneity of variance), and there is compound symmetry (Munro, 2005). Compound symmetry is only a concern with studies that have more than three time points. As this study only has two time points, compound symmetry will not occur. The first assumption is that variances for the dependent variable are normally distributed. Levene's Test of Equality of Error Variance was nonsignificant for both the Pretest Knowledge ($p = .473$) and Posttest Knowledge ($p = .461$), indicating that the assumption has been met and the dependent variable for knowledge is normally distributed. The assumption of homogeneity of variance requirements was met when the Box's test of equality of covariance matrices was not significant ($p = .423$). There was no difference between the two groups on the pretest knowledge scores (independent sample pooled t-test: $t = -1.1613$, $df = 71$, $p = .111$).

Statistical analysis – repeated measures ANOVA. A repeated measures ANOVA was conducted to investigate knowledge differences among a group of students who received medium-fidelity simulation versus a group of students who received low-fidelity simulation. The repeated measure results showed a significant main effect for knowledge ($F(1,71)=9.774$, $p = .003$) with an observed power of .869. The interaction between factors was not significant ($F(1,71) = 1.245$, $p = .268$) with an observed power of .196 (see Figure 3).

The results indicate that there was a significant increase in student's knowledge between the pretest and posttest for both groups. No significant difference in knowledge scores was noted between the medium-fidelity simulation and low-fidelity simulation (paper/pencil case study) groups, the research hypothesis was rejected.

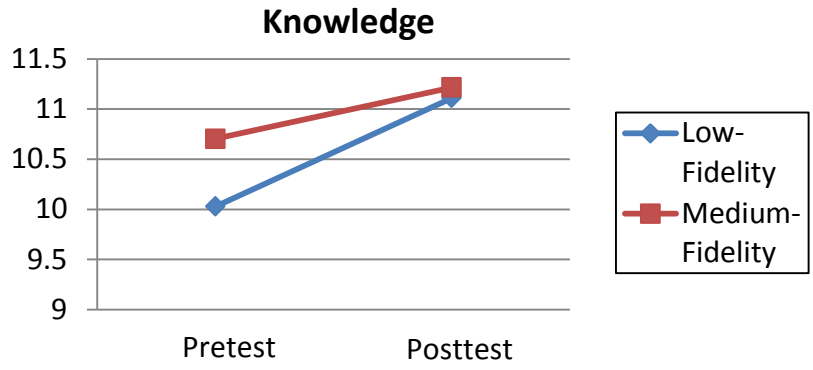

Figure 3. Comparison of knowledge means

Research Question Two Results – Self-Confidence

Question two hypothesis. Nursing students who receive a medium-fidelity simulation learning experience will have higher self-confidence scores than students who receive the low-fidelity simulation (paper/pencil case study) learning experience.

Assumptions for independent sample t-test. The assumptions of the independent sample t-test are: the independent variable is categorical and contains two levels (assumption of independence); the distribution of the dependent variable is normal; variances of the dependent variable for the two groups are similar (homogeneity of variance) (Munro, 2005). The assumptions of the independent sample t-test for self-confidence were all met. Each individual student only contributed one score to one group meeting the assumption of independence. The frequency distribution for self-confidence was not skewed (-1.203) indicating that the dependent variable is normally distributed. The last assumption, homogeneity of variance, was met. Levene's Test of Equality of Variance was not significant ($p = .678$).

Statistical analysis – independent sample t-test. An independent sample t-test was conducted to investigate the difference in self-confidence between two groups of students. One group received a medium-fidelity simulation and the other group received

a low-fidelity simulation. The t-test results showed a significant difference between the two groups (t = 2.213, df = 71, p = .03) (see Table 8).

Table 8

Comparison of Self-Confidence by Group

Group:	Mean	Std. Deviation	Range	n	t	df	p
Low-Fidelity	33.86	3.27	25-38	36	2.213	71	.03
Medium- Fidelity	32.05	3.68	18-40	37			

The results indicate that there was a significant difference between the two groups on self-confidence. The mean score for the low-fidelity group was higher than the medium fidelity group indicating that the low-fidelity group had a higher self-confidence than the medium fidelity group. Since three of the groups of students did not participate in the post-evaluation until Week 8 of the quarter (all other groups completed during Week 4) there is a threat to internal validity of maturation that may have resulted in a significant difference between these two groups because of the difference in clinical times. The self-confidence data for Groups 8 through 10 were compared to Groups 1 through 7 using the independent sample t-test to determine if there was a significant difference between these groups because of the differences in clinical time. There was no significant difference noted between the two groups (t = .093, df = 34, p = .926). This indicates that there is no threat to internal validity of maturation and that there is significant difference between the two groups with the low-fidelity simulation group having a higher level of self-confidence than the medium-fidelity simulation group. Therefore, the research hypothesis was rejected.

Further review of self-confidence in learning. Upon further review of the Self-Confidence in Learning instrument, three of the eight items were considered not related

to self-confidence. These three items (#4, #5, & #8) were removed from the instrument and analysis of the difference between the two groups using the remaining five items was conducted. An independent sample t-test was conducted on the modified instrument to investigate the difference in self-confidence between the two groups of students. The assumptions of the independent sample t-test are: the independent variable is categorical and contains two levels (assumption of independence); the distribution of the dependent variable is normal; variances of the dependent variable for the two groups are similar (homogeneity of variance) (Munro, 2005). The assumptions of the independent sample t-test for self-confidence were not all met. Each individual student only contributed one score to one group meeting the assumption of independence. The frequency distribution for self-confidence was negatively skewed (-2.033) indicating that the dependent variable is not normally distributed. This assumption was not met, but the t-test is considered to be a robust statistical test, so violation of this assumption may slightly affect the results and increases the risk of a Type 1 Error (Burns & Grove, 2009). The last assumption, homogeneity of variance, was met. Levene's Test of Equality of Variance was not significant ($p = .908$).

The five-item instrument reached a desired level of reliability with a Cronbach's alpha = .82. The independent sample t-test results showed a significant difference between the two groups ($t = 3.448$, $df = 71$, $p = .001$) with the low-fidelity simulation group having a higher level of self-confidence than the medium-fidelity simulation group (Mean Low-Fidelity = 22.53; Mean Medium-Fidelity = 20.46). Review of the frequency data for the instrument revealed that the low-fidelity simulation group consistently had twice as many students score the items as strongly agree when compared to the medium-

fidelity simulation group (see Table 9). The medium-fidelity simulation group also consistently had one or more students ranking the items for strongly disagree or disagree. These results support that the students in the low-fidelity simulation group had a higher level of self-confidence than the low-fidelity simulation group (see Table 9).

Table 9

Frequency Data for Self-Confidence

Questions		Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
SC #1 – Mastering content	Low	0	0	2	20	14
	Medium	0	6	3	23	5
SC #2 – Covered critical content	Low	0	0	1	10	25
	Medium	1	0	1	18	17
SC #3 – Confident in skills	Low	0	0	2	16	18
	Medium	1	1	1	26	8
SC#6 – How to get help	Low	0	0	0	10	26
	Medium	0	1	3	19	14
SC#7 – Learn critical aspects	Low	0	1	1	18	16
	Medium	1	0	1	28	7

Research Question Three Results – Skill Performance

Question three hypothesis. Nursing students who receive a medium-fidelity simulation learning experience will have higher skill performance scores than students who receive the low-fidelity simulation (paper/pencil case study) learning experience.

Assumptions for repeated measures ANOVA. The assumptions for the repeated measures ANOVA are: the dependent variable is normally distributed, the variances of the dependent variable for the two groups are similar (homogeneity of variance), and there is compound symmetry (Munro, 2005). Compound symmetry is only a concern with studies that have more than three time points. As this study only has two time points, compound symmetry will not occur. The first assumption is that variances for the dependent variable are normally distributed. Levene's Test of Equality of Error Variance

was nonsignificant for both the Pretest Knowledge (p = .508) and Posttest Knowledge (p = .115), indicating that the assumption has been met and the dependent variable for knowledge is normally distributed. The assumption of homogeneity of variance requirements was met when the Box's test of equality of covariance matrices was not significant (p = .142). There was no difference between the two groups on the pretest skill performance scores (independent sample pooled t-test: t = 1.323, df = 71, p = .190).

Statistical analysis – repeated measures ANOVA. A repeated measures ANOVA was conducted to investigate skill performance differences between the two simulation groups. The repeated measure results showed a significant main effect for skill performance (F (1,71) = 156.3, p < .0001) with an observed power of 1.000. The interaction between factors was not significant (F (1,71) = 2.718, p = .104) with an observed power of .396 (see Table 10 and Figure 4).

Table 10

Skill Performance – Descriptive Statistics

Fidelity – Low or Medium		Mean	Std. Deviation	Range	n
Total Pre OSCE	Low-Fidelity	41.86	8.79	26-66	36
	Medium-Fidelity	39.27	7.94	25-57	37
	Total	40.55	8.41	25-66	73
Total Post OSCE	Low-Fidelity	55.83	9.35	33-75	36
	Medium-Fidelity	57.49	12.31	37-87	37
	Total	56.67	10.91	33-87	73

The results indicate that there was a significant increase in student's skill performance between the pretest and posttest for both groups but no significant difference in skill performance between the medium-fidelity simulation and low-fidelity simulation (paper/pencil case study) groups. The research hypothesis was rejected.

Figure 4. Comparison of skill performance means

Additional Exploratory Analyses

Further analysis was conducted for the entire sample of seventy-three students to determine if there was any improvement in the student's performance of specific skills. These skills included SBAR, patient identification, and safe medication administration. The researcher reviewed the frequencies of yes and no responses for each of the items on the OSCE checklists that coordinated with these particular skills.

SBAR. As part of the simulation experience, both the medium-fidelity and low-fidelity simulation, the use of SBAR (situation, background, assessment, recommendation) was reviewed with the students. SBAR stands for Situation, Background, Assessment, and Recommendation, and is the acronym to use when communicating with the physician when a nurse is concerned about the patient. SBAR is consistently used in all hospitals in the area for this research sample. SBAR was part of Station 6 evaluation of student's skills (OSCE – Station 6).

Because this was a pretest posttest design and students received an educational intervention, the expectation was that student scores would increase between the pretest

and the posttest (see Table 11). This did not occur and as a group, the overall scores for history and background decreased while assessment scores increased. This finding was consistent within the groups as well as in the overall group findings. The overall recommendation scores remained unchanged except there was an increase in notifying the physician of the increased oxygen requirement (see Table 11). This nursing intervention was either performed or reviewed during the simulation experience and that the students demonstrated in the beginning of the OSCE evaluation instrument (Station 6 was linked with Station 5).

Table 11

SBAR - Frequencies

Frequencies	Pre OSCE		Post OSCE	
	Yes	No	Yes	No
Explain History	51	22	36	37
Explain Background – Deep Suctioned per Respiratory	31	42	17	56
Explain Background – Previous oxygen saturation level	28	45	6	67
Current Assessment – Wheezes throughout lung fields	32	41	45	28
Current Assessment – Wheezes even after suctions	3	70	20	53
Current Assessment – Retractions	0	73	13	60
Current Assessment – Nasal Flaring	0	73	3	70
Current Assessment – Capillary Refill	6	67	22	51
Current Assessment – Color Change	2	71	9	64
Recommendation – Aware Increased oxygen	36	37	68	5
Recommendation – Respiratory to reassess	19	54	20	53
Recommendation – Respiratory to suction	16	57	9	64

Patient identification. Patient identification is a required component of safe medication administration in the local hospitals for the areas. All students in this course had previously administered medications in a local area hospital that used bar code scanning for safe patient administration. Also, during one of their previous nursing courses, students were in the skills lab and part of all of the skills check off was verifying the identity of the patient. Students participated in the skills lab nursing course nine

months prior to the current nursing course and it had been four months since they administered medications and were required to verify patient identification by checking the patient's name band.

Patient identification did increase between the pretest and posttest of the OSCE and there was a higher increase for the medium-fidelity group than the low-fidelity group but still over half of the students did not assess the patient identification prior to administering a patient medication (see Table 12).

Table 12

Patient Identification - Frequencies

Frequencies		Pre OSCE		Post OSCE	
		Yes	No	Yes	No
Station 10 – Assess ID	Medium-Fidelity	7	30	21	16
	Low-Fidelity	15	21	19	17
Station 12 – Assess ID	Medium-Fidelity	7	30	23	14
	Low-Fidelity	13	23	9	27

Safe medication administration. As part of clinical preparation, students are required to review all of their patient's medications, identify why their patient is receiving the medications, identify side-effects, and determine if the medication dosages are safe for their patient. Students are routinely required to complete this preparation prior to being allowed to administer medications to their patients. During Station 11 of the OSCE students administered an intravenous antibiotic to the pediatric patient simulator. The medication was Ceftriaxone, which was the same medication that had been used during the simulation experience the week prior to the post evaluation process. All student groups, both medium-fidelity and low-fidelity simulation groups, looked up this medication and identified the safe range, what the medication was routinely prescribed for, and how to administer the medication. The medium-fidelity simulation

group administered the medication during the simulation experience and the administration of this medication was reviewed during the debriefing process for correct administration and administering the medication safely following the five rights. During the post evaluation, most of the students did administer the medication following the five-rights of administration, but did not state the purpose of the medication or how to administer it (see Table 13). The medication should have been administered using a medication infusion pump over half an hour. Students instead administered the medication by IV push over 1 to 2 minutes. Nearly a third of the students did not administer the medication based on the five rights of medication administration.

Table 13

Medication Administration - Frequencies

Frequencies		Post OSCE	
		Yes	No
Assess medication for five rights	Medium-Fidelity	22	15
	Low-Fidelity	23	13
Assess medication for purpose and how to administer	Medium-Fidelity	12	25
	Low-Fidelity	6	30

Summary

A pilot study was conducted with a convenience sample of junior nursing students (n = 21) to determine the feasibility of the medium-fidelity and low-fidelity simulations, the knowledge test, and the OSCE. Modification to the Knowledge Instrument and the OSCE instrument were made following the completion of the pilot study. These modifications were made based on necessary time constraints to allow for data collection for all study participants.

The full study consisted of a convenience sample of all students enrolled in a pediatric nursing course (n = 73). The self-confidence and skill performance instruments

were found to be reliable. The knowledge instrument had content validity but did not show an expected level of reliability using more traditional testing sue to the presence of multiple content areas with limited items in each area. The results of the study indicated that there was a difference between pretest and posttest knowledge and skill performance scores for all students but no difference between the two groups (medium-fidelity simulation and low-fidelity simulation). The low-fidelity simulation group had a significantly higher level of self-confidence than the medium-fidelity simulation group.

Further analysis was conducted for the entire sample to determine if there was any improvement in the student's performance of specific skills. These skills included SBAR, patient identification, and safe medication administration. The research findings indicate that a significant numbers of students did not provide safe and accurate care to the simulation patients. Students also did not retain information from the simulation experience and apply the information during the posttest evaluation. This lack of retention of knowledge and skill performance is of concern.

Chapter V

Discussion

This chapter presents a discussion of the study findings and implications for future nursing education research. Also included is a discussion of the limitations of the study and recommendations for future research.

This research study evaluated the effectiveness of an educational simulation experience (medium-fidelity versus low-fidelity (paper/pencil case study) on nursing students' knowledge, self-confidence, and skill performance. Previous research has been inconclusive as to whether or not medium-fidelity simulation has a higher impact on student knowledge and skill performance than low-fidelity simulation. Previous research has supported that medium-fidelity simulation results in higher levels of self-confidence than low-fidelity simulation. Nursing schools are currently investing thousands of dollars in simulators that have been shown to improve students' self-confidence, but not an increase in students' knowledge or skill performance. The amount of time required to implement one simulation experience with 50 students was a minimum of 6 hours and 40 minutes. This did not include the development or preparation time. Further research is imperative to determine the effectiveness of simulation on not just self-confidence but also skill performance. The simulator is a highly expensive tool, in both dollars and faculty time, if the only educational outcome is an increase in students' self-confidence.

This study was guided by Kolb's experiential learning theory further explained by Zull. This theory supports that students who receive education with the medium-fidelity simulator should have a higher level of knowledge, self-confidence, and skill performance than students who received education with the low-fidelity simulation. This

is because a medium-fidelity simulation should result in more neuronal connections resulting in a higher level of knowledge. The active participation of the student in the medium-fidelity simulation allows the student to actively engage the motor cortex of the brain resulting further in more neuronal connections. The more neuronal connections a student can make the more learning that occurs resulting in a higher level of knowledge and skill performance. If a student has a higher level of knowledge and skill performance, this should result in an increase in self-confidence.

Discussion of Pilot Study Data

A pilot study was conducted with a group of twenty-one pediatric nursing students to determine the reliability of the instruments as well as the feasibility of the educational interventions and the OSCE instrument. The Self-Confidence in Learning Scale and the Objective Structured Clinical Examination (OSCE) were determined to have acceptable levels of reliability. The knowledge instrument had a low level of reliability for the pilot study data. Time limitations due to lack of human observers and number of students needing to be evaluated in a short period of time led the researcher to modify the OSCE and knowledge instrument prior to completing the full study.

The pilot data were analyzed to determine if there was any significant difference between the medium-fidelity simulation experience and the low-fidelity simulation experience (paper/pencil case study) on students' knowledge, self-confidence, and skill performance. The results indicated that there was no significant difference in knowledge, self-confidence, or skill performance between the two groups. This is not an unexpected result as the sample size was small for all research questions. An estimated total sample size of 128 students was required for adequate power of .80. The actual number of

students completing the three tests was 19 for knowledge, 21 for self-confidence, and 13 for skill performance. None of these sample sizes were large enough for adequate power. A larger sample size was needed to be able to evaluate if there was or was not a significant difference between these two simulation groups.

Discussion of Full Study Data

Instruments. The Self-Confidence in Learning and OSCE were both determined to have acceptable levels of reliability for this study. The Self-Confidence in Learning instrument did have an increase in the internal consistency when item #8; a negatively worded item was removed. In future studies it might be beneficial if this item was not the last item on the instrument as students may not pay careful attention to how the item is worded and thus may not pick up the contrast. Instead, they may simply be identifying that they strongly agreed or agreed with all statements since they were satisfied with the experience. The self-confidence scale was determined to have three items (#4, #5, and #8) that were not related to self-confidence.

The knowledge instrument was reviewed by three content experts and determined to have content validity and to include content that focused on caring for pediatric patients in the areas of communication, assessment, nursing interventions, and safety. The instrument did have a low reliability using the Cronbach's alpha test, but this is not an unexpected finding as the knowledge instrument was designed to focus on multiple content areas. These are the same areas that were covered by the Objective Structured Clinical Examination.

Research question one. The results of the study indicate that there was a significant increase in students' knowledge between the pretest and posttest for both

groups. This is an expected result as any educational intervention should result in an increase in the student's knowledge. There was no significant difference in knowledge scores between the medium-fidelity simulation and low-fidelity simulation (paper/pencil case study) groups when comparing their pretest and posttest knowledge scores. This result was not unexpected as both groups received a lecture on caring for children with respiratory issues and during both of the simulation experiences they reviewed the basic knowledge content.

Research question two. The results of the study indicate that there was a significant difference between the two groups on self-confidence. The mean score for the low-fidelity group was higher than the medium fidelity group indicating that the low-fidelity group had a higher self-confidence than the medium fidelity group. This is an unexpected finding because the literature has consistently shown that students who participate in medium-fidelity simulations have higher self-confidence than students who participate in the low-fidelity (paper/pencil case study) simulation.

Use of a self-confidence instrument modified by a panel of experts to remove those items judged not to be consistent with the construct of "self-confidence" s showed that the students in the low-fidelity simulation group had twice as many students choose strongly agree compared to the medium-fidelity simulation group. The medium-fidelity simulation group had one or more students choose strongly disagree and disagree where none of the low-fidelity simulation students choose these options. These results may have occurred because the students who participated in the medium-fidelity simulation believed that the simulation experience highlighted skills that they did not know how to perform. Since the low-fidelity group did not perform skills, what they were unable to do

was not apparent to them and may have resulted in a higher level of self-confidence than the medium-fidelity group.

This is a positive finding as the medium-fidelity simulation group did not have a higher level of knowledge or skill-performance when compared to the low-fidelity simulation group. Having a higher level of self-confidence and not a higher level of knowledge and skill performance may result in unsafe practice. This study provides support for the assumption that medium-fidelity simulation may result in students having an appropriate level of confidence to provide safe care without being overly confident, which might result in unsafe care.

Research question three. The results of the study indicate that there was a significant increase in student's skill performance between the pretest and posttest for both groups. This is an expected result as any educational intervention should result in an increase in the students' abilities. There was no significant difference in skill performance between the medium-fidelity simulation and low-fidelity simulation (paper/pencil case study) groups when comparing their pretest and posttest skill performance scores. This result was surprising as the Objective Structured Clinical Examination (OSCE) that measured skill performance required students to perform the skills that had been reviewed in the simulation experience. The students in the medium fidelity simulation group actively participated in completing these skills, where the low-fidelity (paper/pencil case study) simulation group did not perform any skills during the educational intervention, so a post-test difference between the two groups was expected.

Another surprising result of the study was that the OSCE scores ranged from 0 to 131 points, but the highest score by any student was 97 points with an average score of

57 points for the entire group of seventy-three students. The lack of variance in the students' post scores may account for the inability of the instrument to detect a difference between the two groups.

The OSCE was designed to measure certain safety skills that students were to be performing and had been taught in previous courses and were reviewed during the simulation experience, such as SBAR and medication safety. Also, the focus of two of the stations was on correct administration of oxygen to a pediatric patient. Two other stations focused on IV fluids administration and IV medication administration. The last two skills, IV fluid administration and IV medication administration, are skills the students are not allowed to perform in the pediatric clinical setting due to the risk to pediatric patients. There were quite a few comments from the students that IV fluid administration was a skill that they had never done prior to the OSCE. The OSCE was designed by the researcher to detect for differences in students' skill performance between students who consistently provided safe and accurate care to pediatric patients and students who occasionally provided safe and accurate care to pediatric patients. Overall, these skills were not seen in a majority of the students resulting in the low average OSCE scores which may have been a result of the inability of the OSCE instrument to detect differences between students who consistently provided safe and accurate care and those who only occasionally practiced safe and accurate care.

Discussion of Additional Exploratory Analyses

SBAR. During the simulation experiences all students were exposed to the concept of SBAR. Student scores on the items that measured ability to use SBAR should have increased between the pretest and posttest. Student's scores did not increase for all

these items and as a group, the overall scores for history and background decreased while assessment scores increased. This may have been a result of the intervention as the educational simulation experience focused on nursing assessment and nursing interventions and not on discussing the patient history. During report all students in both the medium-fidelity simulation and the low-fidelity simulation received a detailed patient history from the researcher, but never were required to use or communicate any of the pertinent history findings. For the recommendation step of SBAR, the overall scores remained unchanged except there was an increase in notifying the physician of the increased oxygen requirement. This action was a nursing intervention that was either performed or reviewed during the simulation experience. The simulation experience may have caused students to focus more on the assessment and intervention portion of SBAR than on including the patient's history and making recommendations to the physician for care for the patient based on the assessment. Students did struggle with the recommendation aspect as they typically wanted to notify the physician and call the physician the minute the patient had an increase in oxygen requirement prior to performing any assessment or interventions. This may be a result of the lack of experience that the students have in dealing with this situation. Repeated exposures to the simulation experience and dealing with similar situations may assist with increasing the student's self-confidence and ability to provide care to the patient who is in mild respiratory distress.

Patient identification. Patient identification did increase between the pretest and posttest of the OSCE and there was a higher increase for the medium-fidelity group than the low-fidelity group. Half of the students, however, did not assess the patient's

identification prior to administering a patient medication. This is a safety concern as patient identification should be a routine part of the medication administration process. All students should have automatically assessed the patient's identification prior to administering any of the medications. Three explanations seem possible. First, students may not have considered the OSCE a real situation and did not perform as they normally would. A second potential explanation is that when students administer medications independently without the instructor present, they may forget to perform vital steps in the medication administration process. A third explanation is that students just have not had enough practice with medication administration to have the stage of patient identification become an automatic part of their medication administration process. The design of the study did not provide an opportunity to evaluate these potential explanations.

Safe medication administration. During the post evaluation OSCE, students did not routinely administer the medication following the five rights of medication administration. Students did not remember from the previous week what the medication was for, how to administer the medication (using a medication pump and not giving by IV push), or the safe range. This lack of retention of knowledge is a surprising finding and causes the researcher to wonder if this is a current trend with students that needs to be addressed. If so, identifying ways to increase the retention of medications that are routinely used when caring for pediatric patients is critical.

Costs of Simulation

The cost of the medium-fidelity simulator used for this study was approximately $7000. A high-fidelity child simulator can cost as high as $65,000. The researcher spent a minimum of twenty hours developing the 30 minute simulation with 20 minutes for

debriefing. A total of twenty hours was spent by the researcher to administer the simulation experience to all students in the pediatric nursing course. The twenty hours does not include set up time or general maintenance care of the simulator. There was a minimum of fifty hours by one faculty member devoted to conducting one pediatric simulation experience with the entire class of seventy-three students. To incorporate just four simulations experiences into the pediatric nursing course would require a minimum of 80 hours of actual time with the students. A minimum of ten hours would be needed to develop each simulation scenario. These times do not include set up time or maintenance time. This is a grand total, just for four simulations, of 120 hours plus set up time to run all students through four simulation experiences. If there are two faculty members running the simulation experience, one working with the students and one with the simulator, 200 hours would be required by the faculty members. This is not cost-effective. The results of this study indicated that students who participated in the medium-fidelity simulation had no difference in knowledge, self-confidence, or skill performance scores than students who participated in the low-fidelity simulation. The use of simulation as an educational intervention to improve students' knowledge, self-confidence, and skill performance needs to be evaluated further and the benefits of simulation need to outweigh the costs. Based on the findings of this research study, the cost of simulation as an educational intervention is too high and needs to be further evaluated before continuing to incorporate and potentially requiring simulation as an educational experience in nursing education programs.

Study Limitations

There are several major limitations to this study. The first limitation to this study is inherent to the research design. The ideal study design for this research would have been an experimental research design with randomization of all students into one of three groups and for each individual student to have the same clinical experience. The three groups would have consisted of a control group, low-fidelity simulation group, and medium-fidelity simulation group. This design is possible in an academic setting, but the threat to internal validity related to diffusion of treatment was determined to have likely occurred and so the experimental research design was deemed as being inappropriate in this situation. For this study, a nonequivalent control group pretest/posttest design was used to examine and compare the effects of the two educational interventions: medium-fidelity simulation and low-fidelity simulation (paper/pencil case study). This design was determined to be the most appropriate to control the threats to internal validity of diffusion of treatment, maturation, selection, testing, instrumentation, and history.

This design did not control for the threat of internal validity of regression to the mean where students have a low pretest and higher posttest score because of error (Burns & Grove, 2009). The two groups may not have been statistically significantly different on the variables measured but may have been different enough on things measured and things not measured that contributed to dampening of outcome gains scores. Also, students being required to participate in the simulation and evaluation and being generally unhappy about this requirement may have resulted in low pretest scores due to negativity. These attitudes may threaten the integrity of the study. Last of all, even though there was no statistically significant difference between the two groups, the

medium-fidelity simulation group did have approximately twice as many older students as the low-fidelity simulation group. Older students may react more negatively to evidence that they do not know something, than younger students.

The second limitation identified in this study is the sampling technique. All students were required to participate in the simulation experience and the pretest and posttest evaluations as part of the course requirements. Students were unhappy about being required to complete the simulation experience and the evaluation process in addition to the normal course requirements. Students felt that they should not have been required to complete additional course requirements without some reward. Students also stated that they were being required to spend extra time completing the simulation experience and evaluations. Students did complete these experiences as part of their 80 hours of clinical time for the quarter but perceived that they spent more than the required 80 hours.

Students also voiced frustration because their lack of knowledge at the beginning of the quarter was documented due to being evaluated on pediatric knowledge and skills prior to receiving any lectures or participating in a clinical experience. Many students said it made them feel like they knew nothing. Students were also frustrated with completing the objective structured clinical examination without receiving feedback on how they did or being given their individual scores on the examination. As a group, students did receive feedback on the expected procedure for providing care for the patients for each of the OSCE stations. These negative feelings about the examination and belief that they were being required to spend extra time may have affected the results of the study.

A third potential limitation identified in the study is the lack of authenticity of the simulation experiences and the OSCE to the students' current clinical experiences. The simulations and OSCE were designed to be authentic to the practice of a registered nurse providing care to the pediatric patient with no supervision. Students during the pediatric clinical experience are not allowed to provide unsupervised care to the pediatric patient and are not allowed to administer intravenous medications even with supervision. There is also very limited exposure to administration of oral medications in the clinical setting so students may not have retained how to safely administer medications because of a lack of the need to know as they are not able to perform these skills in the clinical setting.

Another limitation of the study is the OSCE instrument itself. Even though the OSCE had a desirable level of reliability, the small range of scores may have limited the ability of the instrument to detect differences between the two groups. Further development and refinement of the OSCE may result in increased sensitivity and an ability to detect differences between the two groups, if they exist. Time constraints on the OSCE administration was another potential limitation. The fact that the OSCE had to be completed during the students' assigned clinical time presented a challenge. Ideally students would have been required to be evaluated by the same evaluator for all stations and to have unlimited time to complete the stations. This was not possible because students could not be required to complete the simulation experiences and the pre and post evaluation outside of their assigned clinical time. Students also had not previously been exposed to an OSCE so their lack of exposure to this method of evaluation may have influenced the outcome. The last limitation of the study was the limited reliability of the knowledge instrument based on the use of the Cronbach's alpha. Increasing the

number of items designed to measure each concept might enhance the reliability. The use of a different measure of reliability should also be considered

Implications of the Study Findings

Theory. Kolb's theory further explained by Zull supports that both the medium-fidelity simulation and the low-fidelity simulation (paper/pencil case study) should result in a higher level of knowledge and skill performance. The study findings supported this proposition because there was a statistically significant difference for both groups between the pretest and posttest on knowledge and skill performance. The simulation experiences resulted in an increase in students' abilities and resulted in a positive learning outcome. These results support that a huge dose (high level of fidelity and multiple simulation experiences) of simulation is not required to achieve an increase in learning outcomes.

The theory suggests that medium-fidelity simulation should result in a higher number of neuronal connections being made resulting in a higher level of knowledge, self-confidence and skill performance, but the neural connections could not be measured directly. The limited differences between the groups in the expected direction in this study may have been explained by the fact that the students only participated in one simulation experience (either low or medium) and that there may be a need for students to be exposed to the same ideas repeatedly to result in more neuronal connections. Since students were required to participate in the simulation experience, they may not have been fully engaged in the learning experience which may also have resulted in students not participating in all four-stages of the learning cycle. Students did have a concrete experience and reflected on the observations, but, based on the lack of retention of

knowledge and skills, most students did not abstractly conceptualize the experience or participate actively in developing new hypotheses. Thus, this research study did not fully test the theory. Further research needs to be conducted to determine if repetitive exposure to similar experiences helps students become more active participants in the learning experience and more fully engaged in all four-stages of the learning experience.

Nursing education. The implications of this study for nursing education are that further research is needed to determine the effect of using simulation as an educational learning experience on learning outcomes. These learning outcomes need to focus not only on self-confidence, but on students' skill performance. In this study, there was no significant difference between students' knowledge and skill performance for the low-fidelity simulation (paper/pencil case study) and the medium-fidelity simulation. The low-fidelity simulation required less time and money to develop and administer to the students. Faculty members and nursing institutions need to review what the learning outcomes of the educational experience are and determine if a lower technology learning activity, that is less expensive and less labor intensive, will have the same learning outcomes as the higher technology learning experience.

Few educational programs are satisfied to simply increase students' self-confidence as a learning outcome. Outcomes of nursing education typically focus on providing safe and accurate care for the patient. At present, no nursing studies have been located that support that a medium-fidelity simulation is more effective in increasing students' skill performance than a low-fidelity simulation. The current research did not evaluate the high-fidelity simulator which does need to be evaluated to determine its effect on learning outcomes. It is imperative that nurse educators make decisions

regarding use of simulation in nursing education based on a strong pedagogy that is supported with research. Nurse educators need to engage in evidence-based practice to support the educational strategies that are being used to educate nursing students.

Recommendations for Future Research

Future nursing research needs to focus on evaluating the effectiveness of simulations, especially medium-fidelity and high-fidelity, on students' skill performance. Nurse educators must evaluate the effectiveness of these educational tools to determine their impact on learning outcomes, specifically on skill performance. The medium-fidelity simulation may have had a positive influence on retention over time but the difference may not have shown up when the evaluation of skill performance was so close to the simulation experience. Future research needs to be conducted to compare the retention of skill performance over time following based on differences in the simulation experience (medium-fidelity and low-fidelity simulation). Also, a multi-site research study should be conducted to evaluate the effectiveness of simulators across multiple nursing programs to determine if there are specific benefits to the simulation experiences and what can be done to help increase student retention. In addition, studies need to be conducted to evaluate the phenomenon of lack of student retention of knowledge and skill performance and identify if this is a site specific phenomenon or if this is an issue across multiple nursing education programs.

Future research is needed to investigate the legitimacy of the OSCE to be used as an instrument to measure skill performance. The OSCE has the potential to be a legitimate instrument to measure not only skill performance following simulation experiences, but also following clinical experiences. The OSCE may potentially be able

to be used as an evaluation tool to determine students' abilities to perform safely and accurately while in the clinical setting. The OSCE has the potential to be used for nursing licensure examinations to verify that potential nurses have the ability to correctly and safely care for high level patients while not risking patient safety. Further research is needed to determine the feasibility of the OSCE as an evaluation tool of skill performance.

In this study, the medium-fidelity simulation group had less confidence than the low-fidelity simulation group. Further research is needed to evaluate the relationship of self-confidence in learning and determine if they medium-fidelity simulation group is more appropriately confident. A more appropriately confident student will provide safer care. The Self-Confidence in Learning instrument potentially has three items that are not related to self-confidence.

Prior to conducting further research, a factor analysis of the Self-Confidence in Learning scale to determine if the instrument has one factor or multiple factors should be conducted. Additional psychometric testing of the knowledge instrument also needs to occur. Further development of the OSCE is needed to increase the sensitivity of the OSCE instrument to detect differences among the students. The last recommendation for future research is to conduct a longitudinal study to evaluate retention of knowledge and skill performance in relationship to SBAR and medication administration.

Summary

The findings of the study indicated that students in the low-fidelity simulation group had a higher level of self-confidence than students in the medium-fidelity simulation group. This finding was not supported by previous research studies. There

was a difference between the pretest and posttest scores on knowledge and skill performance, but not between the two groups. This indicates that the medium-fidelity simulation did not result in a higher level of knowledge or skill performance than low-fidelity simulation. Medium-fidelity simulators have a higher cost, both in dollars and faculty time, than low-fidelity simulation. Faculty members and nursing institutions need to identify the learning outcomes of the educational experience and determine if a lower technology, that is less costly and less labor intensive, will have the same learning outcomes as the higher technology.

Appendix A

Cover Letter

Nursing 323 includes a variety of learning strategies in addition to lecture and clinical experience. All are designed to enhance your knowledge and skill in caring for pediatric patients. This quarter, Instructor Ann Bowling, will be evaluating these additional learning strategies. This evaluation is important in determining which ones should continue to be used to enhance student learning in this course. The evaluative data being collected will not be a part of your grade for the course but will be used for future planning.

Ms. Bowling will be using this evaluation to partially meet the requirements for her doctoral degree at Case Western Reserve University. If the evaluation of the learning strategies proves useful, she would like to share it with other educators to help them in teaching pediatric nursing. The data you provide may be shared with the wider nursing academic community in a summary evaluation report. At no time will you be identified as an individual. In fact, Ms. Bowling will only be using an evaluation identification number (EID) on the various evaluation forms rather than your name. Each form in your set will have your name on a post-it so that the evaluation form will get to the correct student. By removing the post-it when you complete the form, no names will be permanently attached to the evaluation information. No master list of names and EID numbers will be kept. Thus, once all forms are completed, there will be no way to determine who completed a particular form. All data will be treated confidentially, and if shared in the scientific literature, will not identify the particular class that provided the information.

This method of protecting your identity and the confidentiality of the data has been approved by appropriate people and review boards at Wright State University and Case Western Reserve University.

As part of the clinical requirement for Nursing 323 you are required to participate in all learning activities and to complete the pretest and posttest observations. If you are unable to participate in the learning strategies or pretest or posttest observations due to an excused absence, you will be given a written make-up assignment as is the policy in this course.

Appendix B1

Medium-Fidelity Simulation: Basic Pediatric Asthma Care

Date: Developed 2/18/2010 **File Name:** Basic Pediatric Asthma Care
Discipline: Nursing **Student Level:** Pediatrics
Expected Simulation Run Time: 30 min **Guided Reflection Time:** 20 minutes
Location: Nursing Lab – Pediatric Sim **Location for Reflection:** Bedside

Admission Date: 3/18 Today's Date: 3/18

Brief Description of Client
Name: George Smith **Gender:** M
Age: 7 y.o. **Race:** African-American
Weight: 20 kg **Height:** 114 cm
Religion: Baptist **Major Support:** Mother **Phone:** 775-0001

Allergies: NKDA, No Food Allergies
Environmental – Dust, Smoke, Ragweed, Pollen.

Immunizations: UTD (Up to Date)

Attending Physician/Team: Dr. C Smith

Past Medical History:
History of Asthma, numerous previous admissions for Asthma, allergy testing done when he was 4 years old.

History of Present illness:
Presented to the ER last night with c/o shortness of breath for last 5 hours that has progressively gotten worse. He was outside playing today since the weather was warm.

Social History:
Lives at home with Mom and 2 brothers, Alijah and Samuel. Visits Dad every other weekend. Mom is primary caregiver.

Primary Medical Diagnosis: Asthma

Surgeries/Procedures & Dates: None

Psychomotor Skills Required Prior to Simulation

- Basic pediatric assessment skills
- Receiving report
- Taking vital signs
- Expiratory peak flow meter
- Oxygen therapy
- IV Maintenance
- Medication administration
- Communicating skills (family and respiratory therapy)

Cognitive Activities Required prior to Simulation [i.e. independent reading (R), video review (V), computer simulations (CS), lecture (L)]

- Pediatric Assessment – L & R
- Care of Patient with Respiratory Dysfunction – L & R
- Patient teaching regarding use of expiratory flow meter – L & R

Nursing Diagnosis:

- Ineffective Breathing Pattern
- Fluid Volume Deficit
- Activity Intolerance

Appendix B2

Simulation Learning Objectives

1. Apply the nursing process to initiate care for the hospitalized child with asthma.

2. Assess the hospitalized child with asthma, specifically a thorough respiratory assessment.

3. Determine (plan) the nursing care for the patient based on assessment findings.

    a. Administration of oxygen
    b. Call respiratory therapist for treatment

4. Implement the appropriate care in a safe manner.

5. Evaluate the care provided.

    a. Expiratory peak flow meter
    b. Oxygen saturation levels.

6. Identify the primary nursing diagnosis.

7. Demonstrate therapeutic communications in care of the patient and family.

Fidelity

Setting/Environment

- **ER**
- **Med-Surg**
- **Peds**
- **ICU**
- **OR / PACU**
- **Women's Center**
- **Behavioral Health**
- **Home Health**
- **Pre-Hospital**

Simulator Manikin/s Needed: Vita Sim Child

Props: Vita Sim Child in hospital gown

Equipment attached to manikin:

- **IV tubing with primary line D5 ¼ NS fluids running at 60 ml/hr.**
- **Secondary IV line __ running at _ cc/hr**
- **IV pump**
- **Foley catheter _____cc output**
- **PCA pump running**
- **IVPB with ___ running at ___ cc/hr**
- **02 _____**
- **Monitor attached –** Pulse oximetry (on finger) and HR/RR monitor.
- **ID band –** Smith, George MR#205494

Equipment available in room

- **Bedpan/Urinal**
- **Foley kit**
- **Straight Catheter Kit**
- **Incentive Spirometer**
- **Fluids: D5 ¼ NS with 10 meq KCl/L**
- **IV start kit**
- **IV tubing**
- **IVPB Tubing**
- **IV Pump**
- **Feeding Pump**
- **Pressure Bag**
- **02 delivery device –** Nasal cannula and Face Mask, various sizes.
- **Crash cart with airway devices and emergency medications**
- **Defibrillator/Pacer**
- **Suction**
- **Other –** Expiratory Peak Flow Meter

Medications and Fluids

- **IV Fluids:** D5 ¼ NS at 60 ml/hr. Add 10 meq KCl/L after first void.
- **Oral Meds:**
- **Nebulizer:** Albuterol 6 mg/2 ml Normal Saline every 2 hours per nebulizer. Wean per asthma protocol.
- **IVPB:** Ceftriaxone 500 mg IV every 12 hours.
- **IM or SC:**

Diagnostics Available

- **Labs**
- **X-rays (Images)**
- **12-Lead EKG**
- **Other_____**

Documentation Forms

- **Physician Orders**
- **Admit Orders**
- **Flow sheet**
- **Medication Administration Record**
- **Kardex**
- **Graphic Record**
- **Shift Assessment**
- **Triage Forms**
- **Code Record**
- **Anesthesia / PACU Record**
- **Standing (Protocol) Orders**
- **Transfer Orders**
- **Other –** Drug Book

Recommended Mode for Simulation

Programmed: Patient will be in distress and based on nursing interventions, distress will either improve or not improve.

Appendix B4

Roles / Guidelines for Roles	**Student Information Needed Prior to Scenario:**
• **Primary Nurse** • **Secondary Nurse** ○ **Clinical Instructor** • **Family Member #1** ○ **Family Member #2** ○ **Observer/s** • **Recorder** ○ **Physician / Advanced Practice Nurse** ○ **Respiratory Therapy** ○ **Anesthesia** ○ **Pharmacy** ○ **Lab** ○ **Imaging** ○ **Social Services** ○ **Clergy** ○ **Unlicensed Assistive Personnel** ○ **Code Team** ○ **Other_____**	• **Has been oriented to simulator** • **Understands guidelines /expectations for scenario** • **Has accomplished all pre-simulation requirements** • **All participants understand their assigned roles** • **Has been given time frame expectations** • **Other: Show Primary Nurse the Patient's Chart and Current Physicians Orders.**
Important Information Related to Roles Scripted end of shift report outside patient room from RN leaving night shift to the primary nurse and secondary nurse (on orientation). Family member is sitting at bedside and asks question for nurse to explain everything that she is doing and continuously asks why. Vita Sim Child initially has mild wheezes throughout lung fields with HR 110, RR 24, and oxygen saturation level of 94% on room air. At 15 minutes patient programmed to have an increase in heart rate, respiratory rate, and decreased oxygen saturation level to 88%, and complains of shortness of breath. Lungs sounds are decreased throughout lung fields (tight) with mild expiratory wheezes. If oxygen applied correctly oxygen saturation level increases to 96%, if no oxygen applied or applied at incorrectly, no change in assessment. Once respiratory called for a treatment, patient has increased breath sounds.	**Report Students Will Receive Before Simulation** **Time: 0715** George is a 7 year old male admitted to the unit at 0300 this morning. George arrived at the hospital with his mother at 2100 yesterday evening. He received multiple albuterol treatments in the emergency room. Respiratory: On arrival to the unit lungs had good aeration with some expiratory wheezes noted in all lung fields. Respirations were even and unlabored and his oxygen saturation level was 94% on room air. George's last treatment was at 0600 and his albuterol treatments have been stretched to every 3 hours. Cardiac: Apical pulse is strong and regular, is tachycardic at 110. On a heart rate and respiratory rate monitor

Recorder completes the observation checklist and is responsible for beginning the debriefing session. If Respiratory Therapist is called – ask about how patient sounds and reports to room. **Significant Lab Values** SpO_2 decreases to 88% from report **Physician Orders** – Vital Signs every 4 hours – Strict I & O – Regular diet – Continuous pulse oximetry, start O_2 to maintain oxygen saturation level > 92%. – HR/RR monitor at all times – Ceftriaxone 500 mg IV every 12 hours. Due at 0800. – D5 ¼ NS at 60 ml/hr. Add 10 meq KCl/L after first void. – Albuterol 6 mg/2 ml Normal Saline every 2 hours per nebulizer. Wean per asthma protocol. – Acetaminophen (Tylenol) 200 mg po every 4 hours prn for Temp > 38.5°C.	GI: Positive bowel sounds and abdomen is soft and flat. Has had 240 ml of juice since arrival to the unit, no solids. GU: Just voided 200 ml of clear yellow urine, have not yet changed IV fluids, could you please do this for me. Neurological: He is alert, oriented X3, and currently very tired as he has been awakened every couple of hours tonight for a treatment. Was just weaned to every 3 hours with his last treatment. Family: Mom is at the bedside, worried about her son and also worried about her other 2 boys. They are currently with Grandma.

References, Evidence-Based Practice Guidelines, Protocols, or Algorithms Used For This Scenario: (site source, author, year, and page)

Asthma Care Guidelines per Perkins, Swift, Newton, and Anas (2008).

Perkin, R. M., Swift, J. D., Newton, D. A., & Anas, N. G. (2008). *Pediatric hospital medicine: Textbook of inpatient management* (2nd ed.). Philadelphia: Lippincott Williams & Wilkins

Appendix B6

Scenario Progression Outline

Timing (approximate)	Manikin Actions	Expected Interventions	May Use the Following Cues
5 minutes	No change from initial assessment	Change IV fluids from D5 ¼ NS at 60 ml/hr to D5 ¼ NS with 20 meq KCl/L at 60 ml/hr per physicians order. Complete Assessment Family Member asking why they are assessing the patient and why IV fluids were changed.	**Role member providing cue:** **Recorder Cue:** What are those IV fluids for?
10 minutes	No change from initial assessment	Administer Cefuroxime using the medication infusion pump. Family Member asks what is that medication for? Why are you giving it to him in his IV?	**Role member providing cue:** **Recorder Cue:** When are your medications due?
15 minutes	Heart Rate 150 Respiratory Rate 44 Lungs Sounds with diminished breath sounds throughout lung field (tight), mild expiratory wheeze. Oxygen saturation level 88% on room air.	Apply oxygen at 2 liters per nasal cannula. Call respiratory therapist for treatment. Respiratory therapist to perform assessment and expiratory peak flow meter and administer albuterol treatment.	**Role member providing cue:** **Pt Cue:** I am having a hard time breathing. **Family Member Cue:** He seems awful short of breath can't you do something for him?

Appendix B7

20 minutes	If oxygen applied and respiratory therapist called to give treatment – patient has moderate expiratory wheezes throughout lung fields but good aeration, heart rate 110, respiratory rate 24, pulse oximetry 96% on 2 liters per nasal cannula. If not called, patient continues to complain of shortness of breath	If better: Nurse to reassess and document that interventions were successful. Nurse to explain to patient and his mother what occurred, what was done, and the need to call if he begins to feel that bad again. Nurse to explain situation to respiratory therapist and the need for the treatment, using SBAR Respiratory therapist to perform expiratory peak flow meter and administer albuterol treatment.	**Role member providing cue:** **Pt Cue: I am having a hard time breathing and feel like I am going to pass out.** **Family Member Cue: Please call someone he seems to be getting worse.** **Respiratory Therapist Cue: Walks in Room. Can I help you with something?**
25 minutes	Treatment Performed – Patient better see parameters above.	Nurse to reassess and document that interventions were successful. Nurse to explain to patient and his mother what occurred, what was done, and the need to call if he begins to feel that bad again.	**Role member providing cue:** **Family Member Cue:** Please tell me what happened.

Appendix B8

Debriefing / Guided Reflection Questions for This Simulation

1. Question to ask the Primary Nurse, Secondary Nurse, and Family Member
    a. How did you feel throughout the simulation experience?
2. Recorder reviews the Observation Checklist:
    a. Describe the objectives that were achieved
    b. Describe the objectives that were not met.
    c. What did the group do well?
    d. Could the nurses have handled any aspect of the simulation differently?
3. Question to ask the Primary Nurse and Secondary Nurse
    a. Did you have the knowledge and skills to meet objectives?
    b. Were you satisfied with your ability to work through the simulation?
    c. If you were able to do this again, how could you have handled the situation differently?
4. What did the group feel was the primary nursing diagnosis?
5. What were the key assessments and interventions?
6. Review administration of IVPB Medications.
7. Is there anything else you would like to discuss?
8. Describe the objectives you were able to achieve?
    a. Which ones were you unable to achieve (if any)?

Complexity – Simple to Complex

Appendix B9

Observation Checklist

George Smith: Basic Pediatric Asthma Care

Learning Objective:	**Behavior:**	**Met:**
Demonstrate appropriate care of a patient with asthma after 7 a.m. report		-Performs VS and a complete head-to-toe assessment -Identifies changes in respiratory status - decrease in SpO2 and increase in respiratory rate - Performs thorough assessment of lung sounds (anteriorly and posteriorly)
Prioritizes nursing care		-Assesses before performing interventions -Assesses for cause of low SpO2 and decreased breath sounds. -Places oxygen on patient -Contacts respiratory therapist for treatment. -Evaluates patient after each intervention
Demonstrates effective communication		-Uses appropriate verbal/nonverbal with patient -Uses appropriate verbal/nonverbal with other health care providers (respiratory therapist) - Uses appropriate verbal/nonverbal with family - Correctly educates family on use of expiratory peak flow meter.
Administers an IV medication		-Correctly administers medication by IVPB using a medication infusion pump.
Changes and Maintains and IV Maintenance Infusion		-Notes need to change IV fluids following report. -Changes IV fluids following protocol.

Appendix C1

Case Study: Basic Pediatric Asthma Care

Cognitive Activities Required Prior to the Simulation

- Pediatric Assessment – Lecture and Independent Reading
- Care of Patient with Respiratory Dysfunction – Lecture and Independent Reading
- Patient teaching regarding use of expiratory flow meter – Lecture and Independent Reading

Case Study Learning Objectives

1. Apply the nursing process to identify care for the hospitalized child with asthma.*

2. Identify the required assessment skills for the hospitalized child with asthma, specifically a thorough respiratory assessment.*

3. Determine (plan) the nursing care for the patient based on assessment findings.

    c. Administration of oxygen
    d. Call respiratory therapist for treatment

4. Identify safe and appropriate nursing care.*

5. Identify evaluation criteria for interventions.*

    a. Expiratory peak flow meter
    b. Oxygen saturation levels.

6. Identify the primary nursing diagnosis.

7. Identify therapeutic communication techniques to use when providing care to the pediatric patient and family.*

    * Indicates a learning objective that is different from the medium-fidelity simulation experience because of the inability for students to demonstrate care or evaluate the care that was provided.

Expected Time to Complete the Case Study: 30 minutes

Guided Reflection Time: 20 minutes

Appendix C2

Admission History and Physicians Orders
Provided to Students in Writing at Beginning of Case Study

Admission Date: 3/18 **Today's Date: 3/18**

Brief Description of Client
Name: George Smith **Gender:** M **Age:** 7 y.o. **Race:** African-American
Weight: 20 kg **Height:** 114 cm **Religion:** Baptist **Major Support:** Mother
Phone: 775-0001 **Allergies:** NKDA; Environmental – Dust, Smoke, Ragweed, Pollen; No Food Allergies
Immunizations: UTD (Up to Date) **Attending Physician/Team:** Dr. C Smith

Past Medical History: History of Asthma, numerous previous admissions for Asthma, allergy testing done when he was 4 years old.

History of Present illness: Presented to the ER last night with c/o shortness of breath for last 5 hours that has progressively gotten worse. He was outside playing today since the weather was warm.

Social History: Lives at home with Mom and 2 brothers, Alijah and Samuel. Visits Dad every other weekend. Mom is primary caregiver.

Primary Medical Diagnosis: Asthma **Surgeries/Procedures & Dates:** None

Physician Orders

- Vital Signs every 4 hours
- Strict I & O
- Regular diet
- Continuous pulse oximetry, start O_2 to maintain oxygen saturation level > 92%.
- HR/RR monitor at all times
- Ceftriaxone 500 mg IV every 12 hours. Due at 0800.
- D5 ¼ NS at 60 ml/hr. Add 10 meq KCl/L after first void.
- Albuterol 6 mg/2 ml Normal Saline every 2 hours per nebulizer. Wean per asthma protocol.
- Acetaminophen (Tylenol) 200 mg po every 4 hours prn for Temp > 38.5°C.

Appendix C3

Report Students Receive at Beginning of Case Study (encourage taking notes).

Time: 0715

George is a 7 year old male admitted to the unit at 0300 this morning. George arrived at the hospital with his mother at 2100 yesterday evening. He received multiple albuterol treatments in the emergency room.

Respiratory: On arrival to the unit lungs had good aeration with some expiratory wheezes noted in all lung fields. Respirations were even and unlabored and his oxygen saturation level was 94% on room air. George's last treatment was at 0600 and his albuterol treatments have been stretched to every 3 hours.

Cardiac: Apical pulse is strong and regular, is tachycardic at 110. On a heart rate and respiratory rate monitor

GI: Positive bowel sounds and abdomen is soft and flat. Has had 240 ml of juice since arrival to the unit, no solids.

GU: Just voided 200 ml of clear yellow urine, have not yet changed IV fluids, could you please do this for me.

Neurological: He is alert, oriented X3, and currently very tired as he has been awakened every couple of hours tonight for a treatment. He was just weaned to every 3 hours with his last treatment.

Family: Mom is at the bedside, worried about her son and also worried about her other 2 boys. They are currently with Grandma

Appendix C4

Questions for Students to Answer

Working in a group of 3 to 4 students, students will answer the following questions. Questions will be provided to the students on note cards (one for each student) and questions answered as a group on a big blank piece of paper. During the Case Study, if students are not identifying required elements, they will receive cues from the instructor. These cues will be similar to the cues provided during the medium fidelity simulation experience. Cues will be provided on a note card to one student in the group, each time a cue is provided it will be provided to a different student in the group.

1. Identify the different systems (ex: resp, cardiac, GI, etc.) that you would assess on this patient and how you would assess them.
2. During your assessment, the patient's family asks you why you are assessing him, he is trying to sleep. What is your response?
3. Based on your report and the patient's orders, identify the nursing interventions and physicians orders that need to be completed in the next half an hour.
    a. Cue: If the patient voided, wasn't there an order that you needed to complete?
    b. Cue: When are your medications due?
4. For the medication methylprednisolone, is the dose safe? How do you mix and administer methylprednisolone? How is it administered? Where do you find this information?
5. The patient's Mom asks you why you changed his IV fluids. What is your response?
6. The patient's Mom asks you what the medication is for and why are you giving it IV. What is your response?
7. After your initial assessment, you notice that the patients pulse oximetry reading (oxygen saturation level) has decreased to 88% on room air. You reassess your patient and find the following: Heart Rate 150; Respiratory Rate 44; Lung sounds with diminished breath sound throughout lung fields (tight), mild expiratory wheeze. What is your initial nursing intervention?
    a. Cue: The patient's Mom asks you: He seems awful short of breath can't you do something for him?
    b. Cue: If no identification of oxygen therapy then: Isn't there a physician's order that is appropriate for this situation?
    c. Cue: If still no identification of oxygen therapy: What can you give him to improve his breathing and decrease his shortness of breath?

8. What would you do next?
    a. Cue: Isn't there anyone you can call?
    b. If decide to call physician and not respiratory therapist give them the following Cue: Isn't there anyone you can call besides the physician?
9. When you call the respiratory therapist, what would you tell them?
10. How do you administer the ordered respiratory treatment?
11. How do you use the expiratory peak flow meter and what is the use of this instrument for this patient?
12. What change in your assessment findings would you expect after placing the patient on oxygen? What change in assessment findings would you expect following the respiratory treatment?
13. After the oxygen and respiratory treatment, the patient now has moderate expiratory wheezes throughout lung field, but good aeration; heart rate is 110; respiratory rate 24; pulse oximetry 96% on 2 liters per nasal cannula. What would you say to your patient and mother at this time?

Appendix C6

Debriefing/Guided Reflection Questions for Case Study

1. How did you feel throughout the case study experience?
2. Did you have the knowledge and skills to meet objectives?
3. Were you satisfied with your ability to work through the simulation?
4. If you were to do the case study again, what would you do differently?
5. Name one thing you learned from completing the case study.
6. Name one thing the case study reinforced that you already knew.
7. What did the group feel was the primary nursing diagnosis?
8. What were the key assessments and interventions?
9. Review administration of IVPB Medications.
10. Is there anything else you would like to discuss?
11. Describe the objectives you were able to achieve?
12. Which ones were you unable to achieve (if any)?

Appendix D

Pre Simulation Survey: Demographics

Subject ID # _____

Please <u>circle</u> or fill in the blank with the best response to the following questions:

1. What is your age
    1. Under 22 years of age
    2. 23 to 30 years of age
    3. 31 to 40 years of age
    4. Over 40 years of age
2. What is your gender?
    1. Male
    2. Female
3. In previous clinical experiences prior to this quarter, have you cared for a patient with any of the following? (circle all that apply)
    1. IV
    2. Nasal Cannula
    3. Face Mask
    4. Respiratory treatment
4. In previous clinical experiences prior to this quarter, have you cared for a patient with any of the following diagnosis? (circle all that apply)
    1. Pneumonia
    2. Asthma

Appendix E

Post Simulation Survey: Demographics

Subject ID # _____

Please <u>circle</u> or fill in the blank with the best response to the following questions:

1. During your current pediatric clinical experiences have you cared for a patient with any of the following? (circle all that apply)
    1. IV
    2. Nasal Cannula
    3. Face Mask
    4. Respiratory treatment
2. During your current pediatric clinical experience have you cared for a patient with any of the following diagnosis? (circle all that apply)
    1. Pneumonia
    2. Asthma
    3. Bronchiolitis/RSV

Appendix F

Permission letter from NLN

It is my pleasure to grant you permission to use the "Student Satisfaction and Self-Confidence in Learning" NLN/Laerdal Research Tool. In granting permission to use the instrument, it is understood that the following assumptions operate and "caveats" will be respected:

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

I am pleased that material developed by the National League for Nursing is seen as valuable as you evaluate ways to enhance learning, and I am pleased that we are able to grant permission for use of the "Student Satisfaction and Self-Confidence in Learning" instrument.

Alyss Doyle | Coordinator of Educational Programming | National League for Nursing | www.nln.org
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Appendix G

Instrument: Self-Confidence in Learning

Instructions: This questionnaire is a series of statement about your personal attitudes about the instruction you receive during your simulation activity. Each item represents a statement about your self-confidence in obtaining the instruction you need. There is no right or wrong answers. You will probably agree with some of the statements and disagree with others. Please indicate your own personal feelings about each statement below by marking the numbers that best describe your attitude or beliefs. Please be truthful and describe your attitude as it really is, not what you would like for it to be. This is anonymous with the results being compiled as a group, not individually.

Mark:

1 = STRONGLY DISAGREE with the statement
2 = DISAGREE with the statement
3 = UNDECIDED – you neither agree or disagree with the statement
4 = AGREE with the statement
5 = STRONGLY AGREE with the statement

Satisfaction with Current Learning	**SD**	**D**	**UN**	**A**	**SA**
1. I am confident that I am mastering the content of the simulation activity that my instructors presented to me.					
2. I am confident that this simulation covered critical content necessary for the mastery of pediatric nursing curriculum.					
3. I am confident that I am developing the skills and obtaining the required knowledge from this simulation to perform necessary tasks in a clinical setting.					
4. My instructors used helpful resources to teach the simulation.					
5. It is my responsibility as the student to learn what I need to know from this simulation activity.					
6. I know how to get help when I do not understand the concepts covered in the simulation.					
7. I know how to use simulation activities to learn critical aspects of these skills.					
8. It is the instructor's responsibility to tell me what I need to learn of the simulation activity content during class time.					

Appendix H1

List of OSCE stations used for the pilot study

Stations		Type
Vital Signs (School-Age Pretest) (Infant Posttest)	1	Practical
Vital Signs Results	2	Theoretical
Application of HR/RR and oximetry monitors	3	Practical
Impending respiratory distress signs	4	Theoretical
Assess Patient in Respiratory Distress Communicating assessment findings with physician – Linked	5 & 6	Practical
Instruct Patient on correct use of Expiratory Peak Flow	7	Practical
Oxygen Device and liters per minute	8	Theoretical
Oxygen Equipment Set Up and Administration	9	Practical
Management of IV Fluids – Fluid Bolus	10	Practical
Administration of IV antibiotic per saline lock.	11	Practical
Pain Assessment	12	Practical

Appendix H2

Objective Structured Clinical Examination Checklists

Station 1: Vital Signs - School-Age Pretest

Instructions: Please assess and record vital signs on 8 month old infant.

Note: Infant Mannequin, thermometer, and automatic blood pressure cuff. Parent (Instructor) at bedside.

Steps	**Performed**	
	Yes	**No**
Assess Oral Temp (a) or Axillary Temp (b)		
1. Perform hand hygiene.		
2. Introduce yourself to the patient and any family members who are in the room.		
3. Assess patient ID – for medical record number and name.		
4. 4a. Provide Privacy and assist client to assume a comfortable position. 4b. Provide Privacy and assist client to a supine or sitting position. Move clothing or gown away from shoulder or arm.		
5. Remove thermometer pack from charging unit. Attach disposable plastic probe cover to stem (blue tip).		
6. 6a. Ask client to open mouth; then gently place thermometer probe under tongue in posterior sublingual pocket lateral to center of low jaw. Ask client to hold thermometer probe with lips closed. 6b. Raise client's arm away from torso; inspect for skin lesion and excessive perspiration. Insert thermometer probe into center of axilla, lower arm over probe, and place arm across client's chest.		
7. 7. Leave thermometer probe in place until audible signal indicates completion, remove thermometer probe.		
8. Discard probe cover into appropriate receptacle, return thermometer stem to storage position and return thermometer to charger.		
Assess Apical Pulse		
9. Assist client to supine or sitting position. Move aside bed linen and gown to expose sternum and left side of chest.		
10. Place diaphragm of stethoscope over PMI at the fifth, at left MCL, and auscultate for normal S1 and S 2 heart sounds.		
11. If apical heart rate regular, count for 30 seconds and multiply by 2. If irregular count for 60 seconds.		
Assess Respirations		
12. Place client's arm in relaxed position across the abdomen or lower chest, or place nurse's hand directly over client's upper abdomen. Also may listen to respirations with stethoscope.		

13. Observe or listen to complete respiratory cycle (inspiration and expiration), after cycle is observed, begin to count rate using a watch with second hand.		
14. If rhythm is regular, count number of respirations in 30 seconds and multiple by 2. If rhythm is irregular, less than 12, or great than 20, count for 1 full minute.		
15. Replace client's gown and bed linen; assist client in returning to a comfortable position		
Assess Blood Pressure: Electronic Measurement		
16. Locate on/off switch, and turn machine on to enable device to self-test computer systems.		
17. Select appropriate cuff size for client extremity and appropriate cuff for machine.		
18. Expose extremity for measurement by removing restrictive clothing to ensure proper cuff application. Do not place BP cuff over clothing.		
19. Wrap flattened cuff snugly around extremity, verifying that only one finger fits between cuff and client's skin. Make sure the "artery" arrow marked on the outside of the cuff is correctly placed.		
20. Verify that connector hose between cuff and machine is not kinked.		
21. Press the start button.		
22. When deflation is complete, digital display will provide most recent values. Remove blood pressure cuff.		
23. Assist client in returning to comfortable position, and cover upper arm if previously clothed.		
24. Review all vital sign findings with patient and/or parent and record measurements.		
25. Perform hand hygiene.		
Total Score out of 25 points		

Appendix H4

Station 2: Vital Signs – Theoretical

Instructions: Answer the following questions.

Questions	**Answered Correctly**	
	Yes	**No**
1. A respiratory rate of 20 to 30 breaths per minute is normal for which of the following age groups? a. 1 year-old **b. 3 year-old** c. 6 year-old d. 12 year-old		
2. A heart rate range of 60 to 110 beats per minute is normal for which of the following age groups? a. Infant to 2 years of age b. 2 to 6 year-old c. 6 to 10 year-old **d. 10 to 16 year-old**		
3. A blood pressure reading of 85/54 is considered normal for which of the following individuals? **a. 1 month old** b. 1 year-old c. 6 year old d. 10 to 13 year old		
4. Fill in the Blank. You will notify the physician if a patient's temperature is greater than _____ °F. **Answer 101 or 101.5**		
5. A nurse must do vital signs on a 2-year-old boy who is brought to the clinic for his 24-month checkup. Select all the criteria the nurse should use in determining the appropriate-size blood pressure cuff. Circle all that apply. a. The cuff is labeled "toddler" b. The cuff bladder width is approximately 40% of the circumference of the upper arm. c. The cuff bladder length covers 80% to 100% of the circumference of the upper arm. d. The cuff bladder covers 50% to 66% of the length of the arm. **Answer b and c**		
Total Score out of 5 points		

Appendix H5

Station 3: Application of HR/RR and oximetry monitors

Instructions: Apply HR/RR and pulse oximetry monitor to your 5 year old patient per physicians order.
Note: Child mannequin with HR/RR monitor and pulse oximetry monitor. HR/RR Leads (EKG leads) and multiple sizes of pulse oximetry probes at the patient's bedside.

Steps	**Performed**	
	Yes	**No**
1. Explain purpose of procedure to client and how you will measure heart rate, respiratory rate, and oxygen saturation.		
2. Perform hand hygiene.		
3. Assess patient ID – for medical record number and name.		
4. Provide Privacy and assist client to a supine or sitting position. Move clothing or gown away from chest.		
5. Attach the three cardiac/respiratory sensors to patient at appropriate sites.		
6. Connect monitoring sensors to cardiac/respiratory monitor.		
7. Once sensors are in place, turn on monitor by activating power. Observe pulse waveform/intensity display and audible beep. Correlate heart rate monitor rate with patient's heart rate. Differences require reevaluation of sensor placements and may require reapplication of sensors.		
8. Since continuous heart rate and respiratory rate monitoring, verify heart rate and respiratory rate limits. Set alarms to appropriate levels for 5-year old patient. For heart rate, low of 80 and high of 180.		
9. Set respiratory alarm limits. 16 for low and 40 for high. Verify that alarms are on.		
Application of Pulse Oximetry Monitor		
10. Attach sensor probe to monitoring site using appropriate size sensor.		
11. Connect sensor probe to pulse oximetry monitor.		
12. Once sensor is in place, turn on oximeter by activating power. Observe pulse waveform/intensity display and audible beep. Correlate oximeter pulse rate with client's radial pulse. Differences require reevaluation of oximeter probe placement and may require reassessment of pulse rates.		
13. Since continuous SpO_2 monitoring, verify SpO_2 alarm limits and alarm volume, which are preset by the manufacturer at a low of 85% and a high of 100%. Set alarms to appropriate levels for pediatrics. Low of 92% and a high of 100%.		
14. Set alarm heart rate limits. 80 for low and 180 for high. Verify that alarms are on.		
15. Assist client in returning to comfortable position.		
16. Perform hand hygiene.		
Total Score out of 16 points		

Appendix H6

Station 4: Impending Respiratory Distress Signs

Instructions: Answer the following questions.

Questions	**Answered Correctly**	
Fill in the blanks.	**Yes**	**No**
1. List 2 out of the 4 cardinal signs of respiratory distress in a pediatric patient a. _____ b. _____ **Answer: Restlessness, tachypnea, tachycardia, and diaphoresis** **1 Point for each correct answer**		
2. List 2 early signs of respiratory distress in an infant. a. _____ b. _____ **Answer: See Page 804 in Hockenberry and Wilson (2009).** **1 Point for each correct answer**		
3. What is the most common cause of cardiopulmonary arrest in children? a. _____ **Answer: Respiratory Failure**		
4. An infant has developed staphylococcal pneumonia. Nursing care of the child with pneumonia includes which of the following? (Select all that apply.) a. Cluster care to conserve energy. b. Round-the-clock administration of antitussive agents. c. Strict intake and output to avoid congestive heart failure d. Administration of antibiotics. **Answer: a and d**		
Total Score out of 6 points		

Appendix H7

Station 5: Assess infant in respiratory distress

Instructions: Michelle is a three month old infant admitted yesterday with Bronchiolitis and RSV. Michelle was deep suctioned nasally and orally by the respiratory therapist 2 hours ago. She is currently on 1 liter of oxygen per nasal cannula and oxygen saturation level has been 95% on higher. Mom just called out and said that she is having a hard time breathing. Complete a physical assessment and any needed nursing interventions. Note: Infant with saline well/heparin well in right hand, 1 liter oxygen per nasal cannula, pulse oximetry and KDC monitor on. Instructor plays the role of Mom.

Steps: Total Score of 25 Points	**Performed**	
Assess Respiratory Status of Infant	**Yes**	**No**
1. Perform hand hygiene.		
2. Talk to Mom and explain to her that you are going to assess her baby.		
3. Assess patient ID – for medical record number and name.		
4. Assess heart rate.		
5. Assess respiratory rate.		
6. Assess pulse oximetry reading.		
7. Assess lung sounds – anteriorly		
8. Assess lung sounds – posteriorly		
9. Assess skin color		
10. Assess capillary refill		
11. Assess use of accessory muscles		
12. Assess nasal flaring.		
Perform Appropriate Nursing Interventions		
13. Explain to Mom your assessment findings and what you are going to do to help Michelle.		
14. Oxygen saturation level is 90% on 1 liter per nasal cannula. Increase oxygen to 2 liters per nasal cannula		
15. Reassess oxygen saturation level. Increased to 92% on 2 liters per nasal cannula.		
16. Suction patient nasally using BBG. Apply nonsterile gloves		
17. Turn on suction – ensure that BBG is connected to suction device		
18. Remove oxygen delivery device. Without applying suction insert BBG into tip of right or left nares.		
19. Apply intermittent suctions for up to 5 to 10 seconds.		
20. Reapply nasal cannula and wait 15 to 30 seconds.		
21. Suction the other nares, again using intermittent suction and no longer than 5 to 10 seconds. Repeat as needed.		
22. Reassess lung status. Oxygen saturation level now up to 93% on room air, but no change in lung assessment.		
23. As you are assessing and caring for Michelle remember to provide reassurance to Mom. Don't panic.		
24. Perform hand hygiene.		
25. Call Physician and Communicate Assessment Findings		

Appendix H8

Station 6: Communicate assessment findings with Physician

Instructions: Michelle's oxygen level has increased to 93% on 2 liters per nasal cannula but she still has an increased work of breathing and respiratory rate of 64. Notify the physician of Michelle's assessment findings.

Note: Orders with number to call are on the bedside table outside patient's room with phone to call and have physician answer. Instructor answers call. SBAR (Situation, Background, Assessment, and Response) hanging on wall across from phone.

Steps	**Performed**	
	Yes	**No**
Assess Respiratory Status of Infant		
1. Page physician		
2. Explain to physician patient history: 3 month old infant admitted yesterday with Bronchiolitis and RSV.		
3. Explain background. Deep suctioned by respiratory therapist 2 hours ago and oxygen saturation level had been 95% on 1 liter per nasal cannula. 2 Points		
4. Explain current assessment: Lungs have expiratory wheezes throughout lung fields even after suctioned with BBG. 2 Points		
5. Mild intercostals retractions and nasal flaring noted. 2 Points		
6. Capillary refill is 3 second and no color change noted. 2 Points		
7. Wanted to make you aware of the patient's increased oxygen requirement and see if a respiratory therapy could reassess the patient and possibly deep suction her again. 3 Points		
8. Also, patient not on IV fluids, has a saline well/heparin well, may we start IV fluids to help thin secretions? 3 Points		
Total Score out of 16 points		

Appendix H9

Station 7: Instruct Patient on correct use of Peak Expiratory Flow Meter

Instructions: Meghan is a 17 year old newly diagnosed asthmatic (just moved her from Texas). Teach her how to correctly use her peak expiratory flow meter.

Note: Instructor fills the role of the patient. Also need Peak Expiratory Flow Meter and Chart to record her PEFM readings.

Steps	**Performed**	
	Yes	**No**
1. Gather required equipment (Meter and Chart to record PEFM readings).		
2. Perform hand hygiene		
3. Introduce yourself to the patient and any family members who are in the room.		
4. Provide Privacy and assist client to a sitting or standing position.		
5. Explain the purpose of the procedure to the patient and his mother and how it will help him control his asthma.		
6. Assess patient ID – for medical record number and name.		
7. Show the patient the meter and let him touch it.		
8. Go over the following directions on how to use the meter. Before each use, make certain the sliding marker or arrow on the peak expiratory flow meter (PEFM) points to zero or is at the bottom of the numbered scale.		
9. Stand up straight.		
10. Remove gum or any food from your mouth.		
11. Close your lips tightly around the mouthpiece. Be sure to keep your tongue away from the mouthpiece.		
12. Blow out as hard and as quickly as you can, a "fast hard puff." Blow from the diaphragm not the cheeks. (Demonstrate what you mean by this.)		
13. Note the number by the marker on the numbered scale.		
14. Repeat entire routine three times; wait 30 seconds between each routine.		
15. Record the highest of the three readings, not the average.		
16. Measure the peak expiratory flow rate (PEFR) close to the same time and same way each day (e.g., morning and evening; before or 15 minutes after taking medication).		
17. Keep a chart of your PEFRs		
18. Ask Jonathon and his mother if they have any questions.		
19. Perform hand hygiene		
Total Score out of 19 points		

Appendix H10

Station 8: Oxygen Devices and Liters per minute

Instructions: Answer the following questions.

Questions	**Answered Correctly**	
Fill in the Blanks:	**Yes**	**No**
1. Nasal Cannula can deliver oxygen between ___ liters and ____ liters for a pediatric patient. **1/8 of a liter to 3 liters per nasal cannula.**		
2. True or False Oxygen delivered by nasal cannula or a simple face mask is always humidified in pediatric patients. **a. True** b. False		
3. A simple face mask can deliver oxygen between ____ liters and ____ liters for a pediatric patient. **5 to 10 liters per simple face mask**		
4. List one other method of oxygen delivery that can be used on infants but not on an adult. _____ **Oxygen hood or oxygen tent**		
5. Respiratory therapy was just in to see your patient whose oxygen saturation level was 98% on 5 liters per face mask and decreased your patient's oxygen from 5 liters to 3 liters per face mask (simple). What nursing interventions if any are required? _____ Why? _____ **Increase oxygen back up to 5 liters as patient will begin to rebreathe their own CO_2 and go into respiratory acidosis.** **2 Points**		
Total Score out of 8 points		

Appendix H11

Station 9: Oxygen Equipment Set-Up and Administration

Instructions: Jordan is a 3 year old admitted with pneumonia whose oxygen level has decreased to 89% on room air. The physician has ordered oxygen to maintain oxygen saturation level greater than 95% on room air.

Note: Mannequin with pulse oximetry probe hooked up. Oxygen saturation level is 89% on room air. Nasal cannula (infant and child), simple face mask (child and adult), and humidifier at bedside. Instructor at bedside fulfilling role of parent.

Steps	**Performed**	
	Yes	**No**
1. Gather required equipment		
2. Perform hand hygiene		
3. Introduce yourself to the patient and any family members who are in the room.		
4. Provide Privacy and assist client to a sitting or standing position.		
5. Explain the purpose of the procedure to the patient and his mother and purpose of the oxygen therapy (help him breathe easier).		
6. Assess patient ID – for medical record number and name.		
7. Attach the nasal cannula or mask to oxygen tubing, and attach to humidified oxygen source adjusted to prescribed flow rate.		
8. If using nasal cannula oxygen level set at 2 liters, if using face mask, oxygen level set at 5 liters per minute.		
9. Place tips of cannula into client's nares, and adjust elastic headband or plastic slide until cannula fits snugly and comfortably. If using an oxygen mask, adjust elastic headband until mask fits comfortable over client's face and mouth.		
10. (Note: Student chose correct face mask or nasal cannula for patient.)		
11. (Note: Face mask or nasal cannula was applied correctly.)		
12. Assess patient's oxygen saturation level.		
13. Oxygen saturation level is 93% on 2 liters per nasal cannula or 5 liters per face mask. Increase oxygen to 3 liters per nasal cannula or 6 liters per face mask to meet physician's order of 95%.		
14. Reassess patient's oxygen saturation level.		
15. Explain your assessment and interventions to the parent and current plan of care. Current plan of care is to monitor patient's oxygen saturation level and decrease his oxygen as he tolerates it.		
16. Pneumonia so will also be on IV antibiotics. Score 2 points if this mentioned.		
17. Perform hand hygiene		
Total Score out of 18 points		

Appendix H12

Station 10: Management of IV Fluids and Fluid Bolus

Instructions: Keith is a 12 year old admitted with severe dehydration and pneumonia. He is currently receiving D5 ½ NS at 75 ml/hr (maintenance rate for Keith). Keith has been in the hospital for 8 hours and has still not voided. The doctor has ordered a fluid bolus of 500 ml of Normal saline to run in over an hour and has increased his maintenance fluids (D5 ½ NS) to 100 ml/hr. You are the nurse caring for Keith and need to complete the physician's orders.

Note: Mannequin with IV and fluids infusing as ordered. Second pump, fluids, and tubing at bedside for bolus (both 0.9% normal saline and 0.45% normal saline). Physician's orders at bedside.

Steps	**Performed**	
	Yes	**No**
1. Gather required equipment		
2. Perform hand hygiene		
3. Introduce yourself to the patient and any family members who are in the room.		
4. Explain the purpose of the procedure to the patient and his mother and purpose of the fluid bolus.		
5. Assess patient ID – for medical record number and name.		
6. Assess current IV fluids that are hanging.		
7. Assess IV site.		
8. Increase maintenance IV fluid rate to 75 ml/hr		
9. (Note: Pump programmed correctly – 1 point).		
10. Spike bag of normal saline and prime tubing.		
11. Load tubing into infusion pump.		
12. Program pump with fluid bolus amount and rate.		
13. (Note: Pump programmed correctly – infusing at 500 ml per hour – 1 point.)		
14. (Note: Maintenance and IV fluid bolus infusing at same time, maintenance fluids were not stopped to infuse the bolus – 1 point.)		
15. Reassess IV site		
16. Instruct patient that there hand may feel cool since fluids infusing at fast rate – 2 points.		
17. Notify nurse immediately if IV site becomes painful. (Risk for infiltration quickly because of high infusion rate.) – 1 point.		
18. Perform hand hygiene		
Total Score out of 19 points		

Appendix H13

Station 11: Administration of antibiotic per saline lock.

Instructions: Keith was admitted 2 days ago for dehydration and pneumonia and has greatly improved. He is no longer on IV fluids or oxygen therapy. Keith is still on his IV antibiotic, Ceftriaxone per IV for his pneumonia and it is due at 12:00 p.m. He has a saline lock in his left hand. The current time is 11:45 a.m. You are the nurse currently caring for Keith and need to administer his antibiotic.

Note: Mannequin or just an arm with ID bracelet and Saline Lock. Medication pump (syringe), labeled medication in syringe, tubing, saline flush, with IV and fluids infusing as ordered. Medication Administration Record for Keith.

Steps	**Performed**	
	Yes	**No**
1. Gather required equipment		
2. Perform hand hygiene		
3. Introduce yourself to the patient and any family members who are in the room.		
4. Explain the purpose of the procedure to the patient and his mother and purpose of the antibiotic.		
5. Assess patient ID – for medical record number and name.		
6. Assess medication for right medication, dose, time, route, and patient – 2 points.		
7. Assess IV site.		
8. Connect medication to tubing and prime.		
9. Load tubing into medication pump (syringe).		
10. Program pump with correct medication and patient's weight.		
11. (Note: Pump programmed correctly – 1 point.)		
12. Clean off injection port with antiseptic swab. Allow to dry.		
13. Flush Saline Well with 0.5 to 3 ml of normal saline		
14. Remove syringe and discard in sharps container.		
15. Assess IV site as your flushing line.		
16. Connect medication to Saline Well.		
17. Start infusion.		
18. Perform hand hygiene		
19. Document medication administration on MAR.		
Total Score out of 20 points		

Appendix H14

Station 12: Pain Assessment

Instructions: Mary, who is five years old, was admitted yesterday for dehydration and pneumonia and has been improving. She still has decreased breath sounds in the right lower and middle lobes with scattered rales throughout her lung fields. She now has a productive cough and is coughing up yellow tinged phlegm. Mary is now complaining of chest and abdominal discomfort. You are the nurse caring for Mary and need to assess the new complaint.

Note: Mannequin with ID bracelet, need way for patient to complain. Need Medication Administration Record with multiple possible pain medications of varying strengths for Mary.

Steps	**Performed**	
	Yes	**No**
1. Perform hand hygiene		
2. Introduce yourself to the patient and any family members who are in the room.		
3. Explain the purpose of the assessment to the patient and her mother.		
4. Assess patient ID – for medical record number and name.		
5. Assess Pain utilizing appropriate scale based on patient's age.		
a. Scale used correctly to assess pain (2 points)		
b. Assess for location, severity, onset, and any patterns (4 points)		
6. Based on pain assessment, identification of need for nursing intervention		
7. Assess MAR for prn pain medications and possible administration (when last given.) (2 points)		
8. Administer pain medication – correct medication for severity of pain (2 points)		
a. Medication administered following five rights of administration (right person, medication, route, time, and dose).		
9. Instruct patient on nonpharmacological pain management techniques (splinting – lying on right side) – 2 points		
10. Perform hand hygiene		
Total Score out of 20 points		

Appendix I1

List of OSCE Stations Used for the Main Study Including the Changes Made from the Pilot OSCE

Stations		Type
Vital Signs (School-Age Pretest) (Infant Posttest)	1	Deleted
Station was Deleted – Repeated in Station 5 below.		
Vital Signs Results	2	Theoretical
Application of HR/RR and oximetry monitors	3	Deleted
Station was Deleted – Repeated in Station 8		
Impending respiratory distress signs	4	Theoretical
Assess Patient in Respiratory Distress		
Communicating assessment findings with physician – Linked		
	5 & 6	Practical
Instruct Patient on correct use of Expiratory Peak Flow	7	Converted to Theoretical and Combined with Station 8
Oxygen Device and liters per minute	8	Theoretical
Oxygen Equipment Set Up and Administration	9	Practical
Management of IV Fluids – Fluid Bolus		
Administration of IV antibiotic per saline lock - Linked	10 & 11	Practical
Station 10 and 11 are now linked stations – this just means that they will be given together and Station 11 was modified since patient now has continuously infusing maintenance fluids.		
Pain Assessment	12	Practical

Appendix I2

Station 2: Vital Signs – Theoretical

Instructions: Answer the following questions.

Questions	**Answered Correctly**	
	Yes	**No**
1. A respiratory rate of 20 to 30 breaths per minute is normal for which of the following age groups? a. 1 year-old **b. 3 year-old** c. 6 year-old d. 12 year-old		
2. A heart rate range of 60 to 110 beats per minute is normal for which of the following age groups? a. Infant to 2 years of age b. 2 to 6 year-old **c. 6 to 10 year-old** **d. 10 to 16 year-old** e. Took both c and d since either could be correct.		
3. A blood pressure reading of 85/54 is considered normal for which of the following individuals? **a. 1 month old** b. 1 year-old c. 6 year old d. 10 to 13 year old		
4. Fill in the Blank. You will notify the physician if a patient's temperature is greater than _____ °F. **Answer 100.4 to 101.5**		
5. A nurse must do vital signs on a 2-year-old boy who is brought to the clinic for his 24-month checkup. Select all the criteria the nurse should use in determining the appropriate-size blood pressure cuff. Circle all that apply. a. The cuff is labeled "toddler" b. The cuff bladder width is approximately 40% of the circumference of the upper arm. c. The cuff bladder length covers 80% to 100% of the circumference of the upper arm. d. The cuff bladder covers 50% to 66% of the length of the arm. **Answer b and c**		
Total Score out of 5 points		

Appendix I3

Station 4: Impending Respiratory Distress Signs

Instructions: Answer the following questions.

Questions	**Answered Correctly**	
Fill in the blanks.	**Yes**	**No**
1. List 2 out of the 4 cardinal signs of respiratory distress in a pediatric patient c. _____ d. _____ **Answer: Restlessness, tachypnea, tachycardia, and diaphoresis** **1 Point for each correct answer**		
2. List 2 early signs of respiratory distress in an infant. c. _____ d. _____ **Answer: See Page 804 in Hockenberry and Wilson (2009).** **1 Point for each correct answer**		
3. What is the most common cause of cardiopulmonary arrest in children? b. _____ **Answer: Respiratory Failure**		
4. An infant has developed staphylococcal pneumonia. Nursing care of the child with pneumonia includes which of the following? (Select all that apply.) a. Cluster care to conserve energy. b. Round-the-clock administration of antitussive agents. c. Strict intake and output to avoid congestive heart failure d. Administration of antibiotics. **Answer: a and d**		
Total Score out of 6 points		

Appendix I4

Station 5: Assess infant in respiratory distress

Instructions: Michelle is a three month old infant admitted yesterday with Bronchiolitis and RSV. Michelle was deep suctioned nasally and orally by the respiratory therapist 2 hours ago. She is currently on 1 liter of oxygen per nasal cannula and oxygen saturation level has been 95% on higher. Mom just called out and said that she is having a hard time breathing. Complete a physical assessment and any needed nursing interventions. Note: Infant with saline well/heparin well in right hand, 1 liter oxygen per nasal cannula, pulse oximetry and KDC monitor on. Instructor plays the role of Mom.

Steps – Total Score out of 25 points	**Performed**	
Assess Respiratory Status of Infant	**Yes**	**No**
1. Perform hand hygiene.		
2. Talk to Mom and explain to her that you are going to assess her baby.		
3. Assess patient ID – for medical record number and name.		
4. Assess heart rate.		
5. Assess respiratory rate.		
6. Assess pulse oximetry reading.		
7. Assess lung sounds – anteriorly		
8. Assess lung sounds – posteriorly		
9. Assess skin color		
10. Assess capillary refill		
11. Assess use of accessory muscles		
12. Assess nasal flaring.		
Perform Appropriate Nursing Interventions		
13. Explain to Mom your assessment findings and what you are going to do to help Michelle.		
14. Oxygen saturation level is 90% on 1 liter per nasal cannula. Increase oxygen to 2 liters per nasal cannula		
15. Reassess oxygen saturation level. Increased to 92% on 2 liters per nasal cannula.		
16. Suction patient nasally using BBG. Apply nonsterile gloves		
17. Turn on suction – ensure that BBG is connected to suction device		
18. Remove oxygen delivery device. Without applying suction insert BBG into tip of right or left nares.		
19. Apply intermittent suctions for up to 5 to 10 seconds.		
20. Reapply nasal cannula and wait 15 to 30 seconds.		
21. Suction the other nares, again using intermittent suction and no longer than 5 to 10 seconds. Repeat as needed.		
22. Reassess lung status. Oxygen saturation level now up to 93% on room air, but no change in lung assessment.		
23. As you are assessing and caring for Michelle remember to provide reassurance to Mom. Don't panic.		
24. Perform hand hygiene.		
25. Call Physician and Communicate Assessment Findings		

Appendix I5

Station 6: Communicate assessment findings with Physician

Instructions: Michelle's oxygen level has increased to 93% on 2 liters per nasal cannula but she still has an increased work of breathing and respiratory rate of 64. Notify the physician of Michelle's assessment findings.

Note: Orders with number to call are on the bedside table outside patient's room with phone to call and have physician answer. Instructor answers call. SBAR (Situation, Background, Assessment, and Response) hanging on wall across from phone.

Steps	**Performed**	
	Yes	**No**
Assess Respiratory Status of Infant		
1. Page physician		
2. Explain to physician patient history: 3 month old infant admitted yesterday with Bronchiolitis and RSV.		
3. Explain background. Deep suctioned by respiratory therapist 2 hours ago and oxygen saturation level had been 95% on 1 liter per nasal cannula. 2 Points		
4. Explain current assessment: Lungs have expiratory wheezes throughout lung fields even after suctioned with BBG. 2 Points		
5. Mild intercostals retractions and nasal flaring noted. 2 Points		
6. Capillary refill is 3 second and no color change noted. 2 Points		
7. Wanted to make you aware of the patient's increased oxygen requirement and see if a respiratory therapy could reassess the patient and possibly deep suction her again. 3 Points		
8. Also, patient not on IV fluids, has a saline well/heparin well, may we start IV fluids to help thin secretions? 3 Points		
Total Score out of 16 points		

Appendix I6

Station 7 & 8: Oxygen Devices and Liters per minute

Instructions: Answer the following questions.

The first three questions were added to this instrument. These were previous Station 7 content that was converted to theoretical questions.

Questions	**Answered Correctly**	
Fill in the Blanks:	**Yes**	**No**
1. What is the purpose of an expiratory peak flow meter? _____		
2. A patient with asthma who is not currently experiencing any respiratory difficulties should use the expiratory peak flow meter: **a. Twice a day** **b. Daily** c. Every other daily d. Once a Week		
3. When would you use the expiratory peak flow meter for a patient who is hospitalized with an acute asthma attack? _____		
4. Nasal Cannula can deliver oxygen between ___ liters and ____ liters for a pediatric patient. **1/8 of a liter to 3 liters per nasal cannula.**		
5. True or False Oxygen delivered by nasal cannula or a simple face mask is always humidified in pediatric patients. **a. True** b. False		
6. A simple face mask can deliver oxygen between ____ liters and ____ liters for a pediatric patient. **5 to 10 liters per simple face mask**		
7. List one other method of oxygen delivery that can be used on infants but not on an adult. _____ **Oxygen hood or oxygen tent**		
8. Respiratory therapy was just in to see your patient whose oxygen saturation level was 98% on 5 liters per face mask and decreased your patient's oxygen from 5 liters to 3 liters per face mask (simple). What nursing interventions if any are required? _____ Why? _____ **Increase oxygen back up to 5 liters as patient will begin to rebreathe their own CO_2 and go into respiratory acidosis.** **2 Points**		
Total Score out of 12 points		

Appendix I7

Station 9: Oxygen Equipment Set-Up and Administration

Instructions: Jordan is a 3 year old admitted with pneumonia whose oxygen level has decreased to 89% on room air. The physician has ordered oxygen to maintain oxygen saturation level greater than 95% on room air.

Note: Mannequin with pulse oximetry probe hooked up. Oxygen saturation level is 89% on room air. Nasal cannula (infant and child), simple face mask (child and adult), and humidifier at bedside. Instructor at bedside fulfilling role of parent.

Steps	**Performed**	
	Yes	**No**
1. Gather required equipment		
2. Perform hand hygiene		
3. Introduce yourself to the patient and any family members who are in the room.		
4. Provide Privacy and assist client to a sitting or standing position.		
5. Explain the purpose of the procedure to the patient and his mother and purpose of the oxygen therapy (help him breathe easier).		
6. Assess patient ID – for medical record number and name.		
7. Attach the nasal cannula or mask to oxygen tubing, and attach to humidified oxygen source adjusted to prescribed flow rate.		
8. If using nasal cannula oxygen level set at 2 liters, if using face mask, oxygen level set at 5 liters per minute.		
9. Place tips of cannula into client's nares, and adjust elastic headband or plastic slide until cannula fits snugly and comfortably. If using an oxygen mask, adjust elastic headband until mask fits comfortable over client's face and mouth.		
10. (Note: Student chose correct face mask or nasal cannula for patient.)		
11. (Note: Face mask or nasal cannula was applied correctly.)		
12. Assess patient's oxygen saturation level.		
13. Oxygen saturation level is 93% on 2 liters per nasal cannula or 5 liters per face mask. Increase oxygen to 3 liters per nasal cannula or 6 liters per face mask to meet physician's order of 95%.		
14. Reassess patient's oxygen saturation level.		
15. Explain your assessment and interventions to the parent and current plan of care. Current plan of care is to monitor patient's oxygen saturation level and decrease his oxygen as he tolerates it.		
16. Pneumonia so will also be on IV antibiotics. Score 2 points if this mentioned.		
17. Perform hand hygiene		
Total Score out of 18 points		

Appendix I8

Station 10: Management of IV Fluids and Fluid Bolus

Instructions: Keith is a 12 year old admitted with severe dehydration and pneumonia. He is currently receiving D5 ½ NS at 75 ml/hr (maintenance rate for Keith). Keith has been in the hospital for 8 hours and has still not voided. The doctor has ordered a fluid bolus of 500 ml of Normal saline to run in over an hour and has increased his maintenance fluids (D5 ½ NS) to 100 ml/hr. You are the nurse caring for Keith and need to complete the physician's orders.

Note: Mannequin with IV and fluids infusing as ordered. Second pump, fluids, and tubing at bedside for bolus (both 0.9% normal saline and 0.45% normal saline). Physician's orders at bedside.

Steps	**Performed**	
	Yes	**No**
1. Gather required equipment		
2. Perform hand hygiene		
3. Introduce yourself to the patient and any family members who are in the room.		
4. Explain the purpose of the procedure to the patient and his mother and purpose of the fluid bolus.		
5. Assess patient ID – for medical record number and name.		
6. Assess current IV fluids that are hanging.		
7. Assess IV site.		
8. Increase maintenance IV fluid rate to 75 ml/hr		
9. (Note: Pump programmed correctly – 1 point).		
10. Spike bag of normal saline and prime tubing.		
11. Load tubing into infusion pump.		
12. Program pump with fluid bolus amount and rate.		
13. (Note: Pump programmed correctly – infusing at 500 ml per hour – 1 point.)		
14. (Note: Maintenance and IV fluid bolus infusing at same time, maintenance fluids were not stopped to infuse the bolus – 1 point.)		
15. Reassess IV site		
16. Instruct patient that there hand may feel cool since fluids infusing at fast rate – 2 points.		
17. Notify nurse immediately if IV site becomes painful. (Risk for infiltration quickly because of high infusion rate.) – 1 point.		
Total Score out of 18 points		

Appendix I9

Station 11: Administration of antibiotic per saline lock.

Instructions: Keith was admitted 2 days ago for dehydration and pneumonia and has greatly improved. He is no longer on IV fluids or oxygen therapy. Keith is still on his IV antibiotic, Ceftriaxone per IV for his pneumonia and it is due at 12:00 p.m. He has a saline lock in his left hand. The current time is 11:45 a.m. You are the nurse currently caring for Keith and need to administer his antibiotic.

Note: Mannequin or just an arm with ID bracelet and Saline Lock. Medication pump (syringe), labeled medication in syringe, tubing, saline flush, with IV and fluids infusing as ordered. Medication Administration Record for Keith.

Steps	**Performed**	
	Yes	**No**
1. Gather required equipment		
2. Explain the purpose of the procedure to the patient and his mother and purpose of the antibiotic.		
3. Assess patient ID – for medical record number and name.		
4. Assess medication for right medication, dose, time, route, and patient – 2 points.		
5. Assess IV site.		
6. Connect medication to tubing and prime.		
7. Load tubing into medication pump (syringe).		
8. Connect medication to Saline Well.		
9. Start infusion.		
10. Perform hand hygiene		
11. Document medication administration on MAR.		
Total Score out of 12 points		

Appendix I10

Station 12: Pain Assessment

Instructions: Mary, who is five years old, was admitted yesterday for dehydration and pneumonia and has been improving. She still has decreased breath sounds in the right lower and middle lobes with scattered rales throughout her lung fields. She now has a productive cough and is coughing up yellow tinged phlegm. Mary is now complaining of chest and abdominal discomfort. You are the nurse caring for Mary and need to assess the new complaint.

Note: Mannequin with ID bracelet, need way for patient to complain. Need Medication Administration Record with multiple possible pain medications of varying strengths for Mary.

Steps	**Performed**	
	Yes	**No**
1. Perform hand hygiene		
2. Introduce yourself to the patient and any family members who are in the room.		
3. Explain the purpose of the assessment to the patient and her mother.		
4. Assess patient ID – for medical record number and name.		
5. Assess Pain utilizing appropriate scale based on patient's age.		
a. Scale used correctly to assess pain (2 points)		
b. Assess for location, severity, onset, and any patterns (4 points)		
6. Based on pain assessment, identification of need for nursing intervention		
7. Assess MAR for prn pain medications and possible administration (when last given.) (2 points)		
8. Administer pain medication – correct medication for severity of pain (2 points)		
a. Medication administered following five rights of administration (right person, medication, route, time, and dose).		
9. Instruct patient on nonpharmacological pain management techniques (splinting – lying on right side) – 2 points		
10. Perform hand hygiene		
Total Score out of 20 points		

References

Ackermann, A. D. (2009). Investigation of learning outcomes for the acquisition and retention of CPR knowledge and skills learned with the use of high-fidelity simulation. *Clinical Simulation in Nursing, 5*, e213-e222. doi: 10/1016/j.ecns.2009.05.002.

Alinier, G., Hunt, B., Gordon, R., & Harwood, C. (2006). Effectiveness of intermediate-fidelity simulation training technology undergraduate nursing education. *Journal of Advanced Nursing, 54*(3), 359-369.

Becker, K. L., Rose, L. E., Berg, J. B., Park, H., & Shatzer, J. H. (2006). The teaching effectiveness of standardized patients. *Journal of Nursing Education, 45*(4), 103-110.

Benner, P. (1984). *From novice to expert: Excellence and power in clinical nursing practice.* Menlo Park, CA: Addison-Wesley.

Benner, P., Sutphen, M., Leonard, V., & Day, L. (2010). *Educating nurses: A call for radical transformation.* San Francisco: Jossey-Bass.

Benner, P., & Wrubel, J. (1982). Skilled clinical knowledge: The value of perceptual awareness. *Nurse Educator, 7*(3), 11-17.

Birch, L., Jones, N., Doyle, P.M., Green, P., McLaughlin, A., Champney, C., Williams, D., Gibbon, K., & Taylor, K. (2007). Obstetric skills drills: Evaluation of teaching methods. *Nurse Education Today, 27*, 915-912. doi:10.1016/j.nedt.2007.01.006

Brannan, J. D., White, A., & Bezanson, J.L. (2008). Simulator effects on cognitive skills and confidence levels. *Journal of Nursing Education, 47*(11), 495-500.

Brink, P. J., & Wood, M. J. (1998). *Advanced design in nursing research* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Brown, D. & Chronister, C. (2009). The effect of simulation learning on critical thinking on self-confidence when incorporated into an electrocardiogram nursing course. *Clinical Simulation in Nursing, 5*, e45-e52. doi: 10.1016/j.ecns.2008.11.001.

Burns, N. & Grove, S. K. (2009). *The practice of nursing research: Appraisal synthesis, and generation of evidence* (6th ed.). St. Louis, MO: Saunders Elsevier.

Butler, K. W., Veltre, D. E., & Brady, D. (2009). Implementation of active learning pedagogy comparing low-fidelity simulation versus high-fidelity simulation in pediatric nursing education. *Clinical Simulation in Nursing, 5*, e129-e136. doi: 10.1016/j.ecns.2009.03.118

Cioffi, J., Purcal, N., & Arundell, F. (2005). A pilot study to investigate the effect of simulation strategy on the clinical decision making of midwifery students. *Journal of Nursing Education, 44*(3), 131-134.

Cohen, J. A. (1960). A coefficient of agreement for nominal scales. *Education and Psychological Measurement, 20*(1), 37-46.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*(2nd ed.). Hillsdale, NJ: Erlbaum.

Dimitrov, D. M. & Rumrill, P. D. (2003). Speaking of research. Pretest-posttest designs and measurement of change. *Work, 20*, 159-165.

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*, 175-191.

Gordon, J.A., Shaffer, D.W., Raemer, D.B., Pawlowski, J., Hurford, W.E., & Cooper, J.B. (2006). A randomized controlled trial of simulation-based teaching versus traditional instruction in medicine: A pilot study among clinical medical students. *Advances in Health Science Education, 11*, 33-39.

Griggs, R. R. (2003). *The effects of the use of a human patient simulator on the acquisition of nursing knowledge in undergraduate nursing students at the University in Illinois.* (Unpublished doctoral dissertation). Southern Illinois University, Carbondale, IL.

Harden, R. M., & Gleeson, F. A. (1979). Assessment of clinical comepetence using an objective structured clinical examination. *Medical Education, 13,* 41-54.

Hockenberry, M. J. & Wilson, D. (2009). *Wong's essentials of pediatric nursing* (8th ed.). St. Louis: Mosby.

Jeffries, P. (2005). A framework for designing, implementing, and evaluating: Simulations used as teaching strategies in nursing. *Nursing Education Perspectives, 26*(2), 96-103.

Jeffries, P. R. (Ed.). (2007). *Simulation in nursing education: From conceptualization to evaluation.* New York: National League for Nursing.

Jeffries, P. R., & Rizzolo, M. A. (2006). *Designing and implement models for the innovative use of simulation to teach nrusing care of ill adults and children: A ntional, multi-site, multi-method study.* Retrieved from NLN website http://www.nln.org/research/LaerdalReport.pdf

Kardong-Edgren, S., Anderson, M., & Michaels, J. (2007). Does simulation fidelity improve student test scores? *Clinical Simulation in Nursing, 3*, e21-e24. doi: 10.1016/j.ecns.2009.05.035

Kardong-Edgren, S., Lungstrom, N., Bendel, R. (2009). VitalSim® versus SimMan®: A comparison of BSN student test scores, knowledge retention, and satisfaction. *Clinical Simulation in Nursing, 5*, e105-e111. doi: 10.1016/j.ecns.2009.01.007

Knudson, M. M., & Sisley, A. C. (2000). Training resident using simulation technology: Experience with ultrasound for trauma. *The Journal of Trauma: Injury, Infection, and Critical Care, 48*(4), 659-665.

Kolb, D. R. (1984). *Experiential learning: Experience as the source of learning and development.* Upper Saddle River, NJ: Prentice Hall.

Lambton, J., & Dudum, T. (2008, October). Simulation as a strategy to teach clinical pediatrics within a nursing curriculum. *Clinical Simulation in Nursing, 4*(3). doi:10.1016/j.ecns.2008.08.001

Lipsey, M. W. (1990). *Design sensitivity: Statistical power for experimental research.* Newbury Park, CA: Sage Publication

Marshall, R. L., Smith, J. S., Gorman, P. J., Krummel, T. M., Haluck, R. S., Cooney, R. N. (2001). Use of a human patient simulator in the development of resident trauma management skills. *The Journal of TRAUMA Injury, Infection, and Critical Care, 15*(1), 17-21.

Morgan, P. J., Cleave-Hogg, D., McIlroy, J., & Devitt, J. H. (2002). A comparison of experiential and visual learning for undergraduate medical students. *Anesthesiology, 96*, 10-16.

Munro, B. H. (2005). *Statistical methods for health care research* (5th ed.). Philadelphia: Lippincott Willliams & Wilkins

Mutlak, N., Euliano, T., Gabrielli, A., & Layon, J. (2002). Human patient simulation: A preliminary report of an innovative training tool for physician assistant education. *Perspective on Physician Assistant Education, 13*(2), 103-105.

Potter, P. A., & Perry, A. G. (2009). *Fundamentals of nursing.* St. Louis, MO: Mosby Elsevier.

Radhakrishnan, K., Roche, J. P., & Cunningham, H. (2007). Measuring clinical practice parameters with human patient simulation. A pilot study. *International Journal of Nursing Education Scholarship, 4*(1), Article 8.

Ravert, P. (2008). Patient simulation sessions and critical thinking. *Journal of Nursing Education, 47*(12), 557-562.

Scherer, Y. K., Bruce, S. A., & Runkawatt, V. (2007). A comparison of clinical simulation and case study presentation on nurse practitioner students' knowledge and confidence in managing a cardiac event. *International Journal of Nursing Education Scholarship, 4*(1), Article 22. Retrieved from http://www.bepress.com/ijnes/vol4/iss1/art22

Schwartz, L. R., Fernandez, R., Kouyoumjian, S. R., Jones, K. A., Compton, S. (2007). A randomized comparison trial of case-based learning versus human patient simulation in medical student education. *American Emergency Medicine, 14*, 130-137. doi: 10.1197/j.aem.2006.09.052

Sloan, D. A., Donnelly, M. B., Schwarts, R. W., & Strodel, W. E. (1995). The objective structured clinical examination: The new gold standard for evlauting

postgraduate clinical performance. *Annals of Surgery, 222*(6), 735-742.

Steadman, R. H., Coates, W. C., Huang, Y. M., Matevosian, R., Larmon, B. R., McCullough, L., & Ariel, D. (2006). Simulation-based training is superior to problem-based learning for the acquisition of critical assessment and management of skills. *Critical Care Medicine, 34*, 151-157.

Tavachnick, B. G. & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). Boston: Pearson.

Tiffen, J., Graf, N., & Corbridge, S. (2009). Effectiveness of a low-fidelity simulation experience in building confidence among Advanced Practice Nursing graduate students. *Clinical Simulation in Nursing, 5,* e113-e117. doi: 10.1016/j.ecns.2009.01.009

Wenk, M., Waurick, R., Schotes, D., Wenk, M., Gerdes, C., Van Aken, H. K., & Popping, D. M. (2009). Simulation-based education is no better than problem-based discussions and induces misjudgment in self-assessment. *Advances in Health Science Education, 14*, 159-171. doi: 10.1007/s10459-008-9098-2.

Yoo, M. S., & Yoo, I. Y. (2003). The effectiveness of standardized patients as a teaching method for nursing fundamentals. *Journal of Nursing Education, 42*(10), 444-448.

Zull, J. E. (2002). *The art of changing the brain: Enriching the practice of teaching by exploring the biology of learning.* Sterling, VA: Stylus.