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Simulation in Undergraduate Nursing Education Curriculum:

An Integrated Review of the Literature

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Abstract

Simulation use in undergraduate nursing education is driven by changes in health care delivery, the need to improve patient safety, a focus on ethical nursing care that considers the rights of patients and a shift to outcomes-based education that allows for assessment and demonstration of competence. In this paper, I present an integrative review of the literature on the use of human patient simulation (HPS) in nursing education guided by a framework based on Whittemore and Knafl (2005). This review indicates that nurse educators who use simulation technology have published critical evaluations of teaching and learning theory informed by their HPS teaching practice. While the use of HPS in undergraduate nursing education is well received by students, teaching faculty have mixed feelings about using this modality due to the steep learning curve required to enact such a dramatic pedagogical change. Educators new to this type of teaching require support with learning the technology, designing the scenarios and feeling comfortable with the simulations they are using. Administrators must expect to spend money for faculty development. In addition to the costs of faculty development, the costs associated with setting up a simulation suite are significant. A structured plan for when, why and how HPS simulation will be used is recommended to ensure that HPS is an effective adjunct to traditional teaching and learning practices. This structured approach must take into account all stakeholders and legislative bodies to maximize the use of simulation technology while meeting the needs of 21st century healthcare.

Simulation in Undergraduate Nursing Education Curriculum: An Integrated Review of the Literature

Problem Identification

Simulation is a fast evolving technology that is being integrated into nursing curricula (Schiavenato, 2008; Harder, 2009). Hodge et al. (2008) suggests simulation “refers to any number of strategies used to replicate the essential aspects of a clinical situation for the purpose of facilitating learning” (p. 210). Simulation in healthcare is a method used to mimic an actual patient care encounter. Using simulation learning, nurses are able to link theory to practice in a non- threatening, realistic setting. They develop collaborative skills while functioning independently of an instructor who usually approves their care plan. “Simulation methods occur along a continuum from very low-fidelity examples, such as using injection pads to help with student’s first injection, to high-fidelity patient simulations...with realistic anatomy and clinical functionality” (p. 210). For the purposes of this paper I will focus on human patient simulation (HPS), a high fidelity genre of simulation learning, in reference to simulation.

In the nursing literature, in light of the patient safety movement, there is evidence of increasing pressure on educational institutions to produce nurses who can perform well in the clinical setting (Arundell & Cioffi, 2005; Kaakinen & Arwood, 2009; Jeffries, 2007). Jeffries (2007) suggests that government and professional organizations understand the importance for educators to prepare nurses who are able to “access and synthesize knowledge; to integrate evidence into practice; to work collaboratively and in interdisciplinary teams; to use clinical information and decision support systems; and to provide safe and ethical care” (p. ix). This ideology is supported by findings in the *Patient Simulation Needs Assessment* that show a requirement for a sufficient supply of simulation technologies and qualified educators and

technicians along with a demand for using human patient simulation to educate healthcare professionals in a variety of interprofessional settings (Canadian Patient Safety Institute [CSPI],2008).

Simulation is one technology that supports student learning by placing students in situations where they can develop confidence in their clinical skills and their ability to connect theory to practice (Leigh, 2008; Sportsman et al., 2009). Simulation supports active learning and allows students to develop critical thinking and reasoning required to work in complex work environments (Cioffi, 2001; Leigh, 2008). Students are able to develop clinical skills without risking patient injury while developing assessment and problem solving skills in a setting that mimics clinical reality. Cant and Cooper (2010) suggest that simulation is an effective teaching and learning strategy when best practice guidelines for it are used. Although teaching clinical skills is not an easy task, it can be improved by using simulation technology (Issenberg, McGaghie, Petrusa, Gordan & Scalese, 2005). Hodge et al. (2008) argue that without a structured plan for when, why and how simulation will be used, HPS is no more than an expensive and rarely used adjunct to traditional teaching and learning practices. Challenges of incorporating HPS into the nursing curriculum include the learning curve required to understand not only the technology but new teaching pedagogies.

Methodology

I chose an integrative review of current nursing simulation literature for my project as it is the broadest type of literature review. An integrative review allows for a review of papers in which diverse methodologies are used. Such an expansive review enables researchers to come to gain the depth and breadth of knowledge required to inform evidence-based nursing practice. However, due to the complexity inherent in synthesizing data from dissimilar research, rigor,

bias and accuracy may be affected. Whitemore and Knafl (2005) suggest that although techniques to enhance data collection and extraction have improved, “methods of analysis, synthesis, and conclusion-drawing remain poorly formulated” (p. 547).

The overarching framework I chose consists of a problem formulation stage, a literature search stage, a data evaluation stage, a data analysis stage and a presentation stage. A schematic version of my framework is found in Appendix A. I relied on Polit and Beck (2008), Garrard (2007) and Davies and Logan (2008) to fashion data collection tools. I developed an EXCEL spreadsheet for data collection, selection of articles and data analysis, and to critique each article that met my inclusion criteria for variables of interest, sampling frame, methodology and data analysis. Finally I coded each article for relevance and theoretical or methodological rigour following Whitemore and Knafl’s (2005) 2.0 rating criteria. My intention was to organize the body of knowledge, which is crucial to provide rigour and reduce error. Torraco (2005) believes that an integrative review is a “sophisticated form of research” and requires “a great deal of research skill and insight” on the part of the researcher (p.356).

Problem Formulation

Simulation in nursing refers to a wide gamut of teaching strategies from task trainers and case study to sophisticated manikins that can be hemodynamically controlled (Bearnson & Wiker, 2005; Cant & Cooper, 2009; Hodge et al., 2008). Simulation may refer to a device that represents a simulated patient or part of a patient (Gaba, 2007) or to activities that mimic the reality of a clinical setting that are used to demonstrate procedures or promote critical thinking and judgment (Jeffries, 2005).

Fidelity in simulation ranges from low to high in relation to the degree it matches reality and resembles a live human being (Hodge et al., 2008). Task trainers and anatomical models are

examples of *low fidelity* simulation; they are used to practice clinical skills such as intravenous cannulation and basic life support (Issenberg et al., 2001). Peer-to-peer learning using case studies or role play (Kinney & Henderson, 2008) is also considered low fidelity. *Medium fidelity* full sized computerized manikins have embedded software that is controlled by an external device. They replicate human anatomy and can be programmed to imitate heart, breath and bowel sounds and provide realistic blood pressure palpitation for nursing students developing clinical skills (Seropian et al., 2004). *High fidelity* computerized mannequins mimic human anatomical physiology (cardiovascular, pulmonary, metabolic and neurological systems) and can respond to nursing or pharmacology interventions in real time. They are currently used in specialty medical fields such as anesthetics and critical care as well as nursing and allied programs. Bremner et al., 2006; Bearnson & Wiker, 2005). The use of these manikins in a laboratory setting that mimics the clinical environment is referred to as human patient simulation (HPS) [Bearnson & Wiker, 2005). For the purpose of my literature search I use the term HPS to refer to simulated learning using either medium or high fidelity mannequins.

Research of theoretical and empirical literature of the last decade indicates that using HPS creates a realistic and safe environment where students can participate in clinical decision making, practice skills and observe outcomes for clinical decisions (Issenberg et al., 2005; Kardong-Edgren et al., 2008). Simulation is supported in the literature as a way to enable students to feel more confident in performing clinical work (Alinier, et al., 2006; Blum, 2010; Lasater, 2006; Leigh, 2008). Based on the rapid development of simulation laboratories in universities and colleges, I chose to focus on high fidelity simulation design and how it is incorporated into existing nursing curricula.

With nursing programs beginning to purchase and use simulation equipment more extensively, it is crucial that its use is guided by a theoretical framework. Harder et al. (2009) suggest that nursing is in the fourth movement of simulation use in nursing education. Pre-simulation nursing education (in the 1950's) is reminiscent of skills being taught in class and practiced on patients; these skills are neither realistic nor considerate of the patients' response (p. 170). Harder et al. (2009) suggest the first movement refers to the creation of the Resusci-Anne mannequin by the toymaker Asmund Laerdal; the mannequin is realistic in appearance and function as well as being affordable (p. 170). The second movement includes the development of more technically advanced equipment, including the first mannequin demonstrating heart and breath sounds, and "respond(ing) to intravenously administered drugs and gases" (p. 170). Task trainers are also developed at this time and become the foundation of modern simulators. In fact Harder et al. (2009) suggest current mannequins are very similar to these early designs. Resistance to the use of this technology to teach clinical skills is present in the 1960's and 1970's, however by the 1980's educators view the use of "high-fidelity manikins" as an important adjunct to teaching (p. 170). The third movement, which continues to this day, witnesses a dramatic reduction in the cost of simulation equipment in relation to its increasing use. While the first three movements of simulation use focus on the creation of simulators and technological advances; the focus today is on advances in accessibility and developing teaching and learning theoretical frameworks that guide design and evaluation (Harder et al., 2009).

Adamson (2009) suggests that nursing programs spend disproportionately large amounts of money on initial investment compared with ongoing spending on maintenance and support of simulation. One way to maximize simulation use in nursing education is to share knowledge on

the use of HPS between facilities for the benefit of educators, educational institutions and nursing curriculum development.

The focus of the integrative review is to answer three questions: (a) how is HPS integration into undergraduate nursing curriculum described in the literature between 2005 and 2010, (b) what theoretical frameworks are used to guide knowledge transfer when HPS is integrated into undergraduate nursing curriculum, and (c) what changes to current pedagogy are required of educators incorporating HPS into undergraduate nursing curriculum and what are their attitudes, behaviors and perceptions as a result?

Literature Search

The inclusion criteria for selecting articles for review was: (a) written in English, (b) peer reviewed journal articles of primary research on nursing simulation written between 2005 and 2010, (c) theoretical articles and research articles of qualitative and quantitative designs, (d) referring to undergraduate nursing pedagogy and (e) referring to human patient simulation using medium to high fidelity manikins. I searched the following databases: CINAHL, ERIC, MEDLINE, Health Source: Nursing Academic (EBSCO) and ProQuest. I noted starred (*) MESH headings to identify HPS themes. Key words consisted of *patient simulation*, *nursing education*, *student learning*, , and *curriculum development*. I performed an ancestry search¹ and found it most useful to find articles meeting my inclusion criteria. Exclusion criteria for the study were articles: (a) published before 2005, (b) not concerned with undergraduate nursing education, (c) referring solely to simulation other than HPS, and (d) unpublished manuscripts, abstracts or dissertations.

An initial literature search using the term of *patient simulation* yielded 140 articles. Using various combinations of search terms (patient simulation, nursing education, student

learning and curriculum) and performing an ancestry search yielded 79 articles. Articles that did not pertain to medium or high fidelity simulation, but to other forms of simulation were eliminated. Of the 79 articles, I chose 38 to review. Articles were eliminated for numerous reasons; some articles were poster abstracts from conferences, some were literature reviews or systematic reviews, some had poorly described methodology and some articles were historical accounts of how institutions integrated simulation into their nursing curriculum. Eleven articles met my inclusion criteria. A list of included and excluded articles is provided in Appendices B & C.

Data Evaluation

The included articles consist of primary empirical and theoretical research in a variety of methods including quantitative, qualitative, and mixed designs. To aid in the evaluation of this diverse group, I used Whittemore and Knafl's coding method that graded methodological or theoretical rigour on a 2-point scale (high or low). Articles are reviewed in order of high or low significance and reports with low rigour or relevance contribute less to the analytic process. Of the eleven articles, eight are rated at (2) and three are rated at (1).

Data Analysis

Whittemore and Knafl (2005) contend there is no gold standard for evaluating quality in research reviews and quality is dependent on the sampling frame. All eleven articles have relevance to the topic, but methodological rigour varies and this is the criterion I used to code the articles. Data were extracted from primary sources using a template based on Polit and Beck (2007). Categories extracted include type of study, key concept and variables of interest, conceptual framework or theory, sample size and characteristics, data sources, statistical tests and findings. Use of an EXCEL spreadsheet facilitated this phase of the integrative review.

Literature Review

Studies that Rated a 2.0

There are 8 articles rating a 2.0 for theoretical and methodological rigour on the relationship between HPS and self-efficacy and competence in clinical nursing skills.

Alinier, Hunt, Gordon and Harwood (2006). In the first article, “Effectiveness of Intermediate-Fidelity simulation Training Technology in Undergraduate Nursing Education”, the authors research the effect of scenario-based simulation training on nursing students’ clinical skills and competence. The authors contend that access to simulation technology is increasing; however there is little scientific evidence to prove there are any benefits over conventional teaching methods. They refer to reasons for the increase in simulation technology (lack of clinical experience and the need to produce practice-ready professionals), identify that the use of simulation enables experiential learning and acknowledge the importance of providing nursing students the ability to practice clinical skills in a safe environment for both practitioner and patient. They also agree with others (Ziv et al., 2000; Owen & Plummer, 2002; Kneebone, 2003) that clinical skills learned in the simulated environment must be transferable to the clinical setting (p. 360). However, they question if the cost of setting up a simulation lab and training staff is justified in the learning outcomes of the nursing students. The purpose of the study was to examine the value of the use of simulation in nursing education and test the hypothesis that students exposed to HPS will have higher clinical performance scores. The researchers provide a background on the development and use of “full-scale” patient simulators from the 1960’s to the present day and identify that most studies are based on small sample sizes, present subjective results based on participant feedback and explore if the technology as a teaching tool is beneficial and cost-effective (p. 360).

The sample is comprised of 344 undergraduate nursing students enrolled in the second year of a United Kingdom *Diploma of Higher Education in Nursing* programme who are invited to participate in the study. There is a 39% response rate and a final 29% participation rate (n=99); both the response and participation rate are disappointing and contribute to participation bias. The average age of the participants is 31.2 and 84% are female. There is no mention of previous experience with simulation, ethnicity or GPA. The average age and gender correspond to the student population.

The quantitative method is a pre-test/post-test design where volunteer students are randomly assigned to a control and intervention group. The intervention group, in addition to taking the regular curriculum and clinical, is exposed to two simulation sessions. Both groups are tested using a 15-station Objective Structural Clinical Examination (OSCE) evaluation instrument. Both groups are retested with the OSCE after 6 months and their test scores are compared. The researchers deal with test reliability in the experimental group by allowing a 5 week delay between the simulation session and the second OSCE. Both groups also complete a 5-point Likert questionnaire measuring their confidence and stress level working with technology in healthcare. Data from the questionnaire are used to determine students' previous healthcare experience and to confirm that both groups are comparable. The researchers use the first OSCE for summative evaluation and determining students' baseline clinical knowledge and skills. The final OSCE is a mixed evaluation design in that it collects data and provides direct feedback to students. Feedback is an important part of simulation design (Jeffries, 2007; Lasater, 2007).

The OSCE, according to the authors, has been used successfully to evaluate trainee doctors and other allied health professionals and is rated as a reliable assessment method (p.

362). A 15-station instrument is developed for this study and content validity is provided by a panel of educators. Students have 5 minutes per station plus 1-minute to rotate to the next station for a total examination time of 90 minutes. The OSCE consists of four theoretical stations and 11 stations assessing clinical knowledge, communication skills and clinical skills.

The simulation session design provides a realistic, clinical experience and covers material not contained in the OSCE. The sessions consist of a briefing, video recorded clinical scenario and debriefing session for a total of 3 hours. The format of the simulation is well developed and students are given an introduction to teamwork and communication, simulation design and patient information. The points observed are communication, teamwork, situation awareness, decision-making and clinical skills in caring for pre- and postoperative patients. Students are divided into two groups of four each, with one group participating and the other group observing. This format supports experiential learning and the development of clinical judgment. Tanner (2006) identifies noticing, interpreting, responding and reflecting as major components of clinical judgment in complex patient care situations (p. 208). The researchers identify their expectation that students will benefit from watching their peers perform in the clinical scenarios and participate in the debriefings. There is no mention of the clinical experience of the control group to compare with the HPS scenarios. Quantitative data analysis is provided by using SPSS, version 11.0 and identifying statistical significance with *t*-tests. A Mann-Whitney *U*-test is used to analyze results of the questionnaire.

The results of the OSCE tests show a mean increase of 7 percentage points for the experimental group over the control group when comparing the results of OSCE 1 and OSCE 2. The researchers indicate this is statistically significant. There is no statistical difference between groups for perception of stress and confidence in working in a technological environment.

The findings prove the study's hypothesis that the experimental group would perform better in the OSCE test. The primary variables of clinical skills and competence improve for the experimental group when exposed to intermediate fidelity simulation. The finding supports the use of HPS in nursing education; however students should play the major role in the scenarios. The educator facilitates the learning. Common themes identified in this study are that HPS supports experiential learning and skill development, the importance of regular feedback to direct learning and the use of simulation to improve the quality of teaching and learning. Other themes relate to the need to produce practice ready professional nurses who demonstrate patient safety competencies identified as important in the Institute of Medicine's 1999 report "To Err is Human: Building a Safer Health System" (Kohn et al. 1999, p. 179, cited in Alinier et. al. 2006, p. 360).

This study has an adequate sample size and the researchers appear to develop valid evaluation instruments and simulation scenarios. All aspects of the study (OSCE and simulation scenarios) are pilot tested prior to the start of the study and the simulation design is modified as a result. The authors identify the purpose, design type, description of measures to collect and analyze data and statistical importance. There is no theoretical or conceptual framework identified, however Cioffi (2001) is cited as linking experiential learning to the use of simulation. The sample characteristics are described; however factors such as ethnicity, GPA and previous experience with simulation are absent. There is a good description of the methodology. The students participate on their own time and are mature students with family commitments. This contributes to participation bias along with the fact that only 29% of the nursing population is represented in the study. However the average age and gender match the overall class mean. These authors do not identify if the skills learned in the simulated scenarios are transferred to the

clinical setting. I agree with Schiavenato (2009) that this study does not prove whether the 7% improvements in test scores are a result of the simulation experience or the additional training received in the “well-structured simulation scenarios”. If the researchers had substituted the clinical portion of the curriculum for simulation in the experimental group, it may have been evident. Also, students in the control group did not benefit from extra clinical experience of an equivalent amount of time, so they may have been at a disadvantage.

Blum, Borglund and Parcells (2010). The second study rating a 2.0 for methodological and theoretical rigour is “High-Fidelity Nursing Simulation Impact on Student Self-Confidence and Clinical Competence” by Blum, Borglund and Parcells (2010). In this quantitative study the authors explore the relationship between HPS and student self-confidence and clinical competence. In this study students rate their self-efficacy and faculty rate clinical competence. The researchers hypothesize that students exposed to HPS as the primary method of learning nursing assessment and skills will experience greater self-confidence and competence compared to the traditional approaches of skill development.

High-fidelity mannequins used in this study are comparable to intermediate fidelity ones and provide similar realism. The researchers identify the theoretical framework as Tanner’s (2006) Clinical Judgment Model embodied in Lasater’s (2007) Clinical Judgment Rubric. In Tanner’s (2006) model, the presumption is that nurses react to clinical situations by drawing on their self-confidence, critical thinking and clinical competency as part of their clinical reasoning process. Therefore simulation is beneficial by providing a safe environment in which to perfect clinical skills and increase student self-efficacy. The theoretical framework is identified as Boykin and Shoenhofer’s (2001) Nursing as Caring. Authors posit that the study “serves to advance the literature related to simulation, caring, self-confidence, and clinical competence” (p.

3). Another key concept of the study is to determine the best placement of simulation in the nursing curriculum, an identified concern of Schiavenato (2009), who states "...the answer to *how* simulation is applied in nursing education appears to be piecemeal and lacking a comprehensive approach" (p. 392). Schiavenato identifies two uses of HPS, one for basic skills training usually found in a nursing foundations course and another, used later in the nursing curriculum as an adjunct for clinical experience (p. 392). The focus of this study is on the experience of undergraduate nurses in a nursing foundations course.

The authors identify the value of simulation found in the literature, which includes themes of patient safety, providing low-risk learning opportunities for students to develop clinical skills and the need to provide competence-building in introductory nursing courses to support the development of critical thinking and prioritization. Historically, student self-confidence was rated by the educator but the researchers observe that this approach "fails to capture student self-perception of self-confidence" (p. 2). The study is designed to reverse this trend and students rate themselves for self-confidence levels.

The convenience sample consists of 53 entry level undergraduate nursing students in their junior year randomly assigned to one of two lab sections. Sample characteristics are identified as 88% female, 68% Caucasian, 56% have no prior healthcare experience and the mean age is 30 years. Age and gender characteristics compare to the average population of nursing students. Sixty-six per cent were not working for wages during data collection.

This quasi-experimental, quantitative study is designed within the context of a health assessment and skills course. All students are enrolled in a 13 week didactic course and randomly assigned to a control or experimental group; the control group demonstrates skill through the use of task trainers or volunteer students and the experimental group demonstrates

skill through HPS scenarios. There are identical learning outcomes for both groups with emphasis on development of self-confidence and clinical competence in a caring framework. An average of two or three nurses participates in the HPS scenarios at a time, and they rotate nursing roles. Educators provide the voice of the patient and the role of a family member; they direct learning through the use of focused comments.

The evaluation instrument used is the Lasater Clinical Judgment Rubric [LCJR] (Lasater, 2007). Both students and faculty complete the 11-item LCJR, and faculty members complete the LCJR independent of determining a student's grade. Content validity is provided by nursing faculty to reflect entry level nursing student confidence and clinical competence. Internal reliability and validity are rated using Cronbach's alpha (range .886-.931). Data analysis is provided by SPSS v. 17 and "cross-tabulations, Pearson's correlations, Cronbach's alpha, and paired samples *t*-tests" are used to compare test results (p. 7).

These authors do not prove the hypothesis and instead show that student self-confidence and competence increase regardless of the intervention. The evaluation instrument is supported as valid through the correlation data. The researchers suggest that the sample may have progressed regardless of the mode of teaching due to the fact they are entry level students. Also, the health assessment and clinical foundations course is designed to build on prior student self-confidence and competence by scaffolding the learning. These findings suggest the use of expensive simulation equipment may better used later in the nursing curriculum when more complex critical thinking and reasoning skills are required. The researchers suggest that bias was evident in the small sample size and this would affect the power effect required. The study does not calculate the smallest sample size required to show statistical significance. The researchers suggest that a longitudinal study of the growth of student self-confidence over the course of the

nursing curriculum would be helpful. I agree with their suggestion as it may shed light on which parts of the curriculum would be advantageous to use this sophisticated technology. It is refreshing to read a study that outlines a theoretical framework guiding the research design. The authors operationalize Tanner's (2006) Clinical Judgment Model by using Lasater's (2007) Clinical Judgment Rubric to evaluate "the transfer of nursing knowledge, confidence, and competence from the laboratory to the clinical setting" (p. 1). This study uses a unique evaluation instrument to measure student self-confidence and competence.

Howard, Ross, Mitchell and Nelson (2010). The third study rating a 2.0 is Howard, Ross, Mitchell and Nelson's (2010) "Human Patient Simulations and Interactive Case Studies: A Comparative Analysis of Learning Outcomes and Patient Perceptions". The study purpose is to compare students' learning and perceptions regarding their learning, using two educational interventions, HPS and interactive case studies (ICS). ICS is a common teaching strategy used to develop critical thinking and evaluate student comprehension of the curriculum. The researchers state that ICSs are cost effective and highly regarded by teaching faculty as a teaching method, hence another aspect of this study is to compare ICS with HPS for cost effectiveness.

Common themes identified by the researchers in the HPS literature include patient safety, the ability of HPS to "duplicate scenarios that nursing students are likely to encounter in clinical practice", and to provide a safe environment to practice clinical skills with no harm to patients (p. 43). Trossman (2005) and Vandrey and Whitman (2001) are referenced as indicating HPS is valuable to orient new nurse graduates and to provide staff development related to critical events such as shock, myocardial infarction, airway emergencies and cardiac arrest. Evaluating algorithms, teaching neonatal skills to novice nurses and teaching medication administration are other benefits of HPS identified in the literature review. Negative comments about HPS are

identified as a lack of valid and reliable assessment tools, little instruction on their use within the nursing curriculum and a paucity of quantitative studies.

The convenience sample consists of 49 senior nursing students from a variety of nursing programs; 13 BSN, 13 Accelerated BSN and 23 Diploma nursing students from a university and hospital-based school of nursing. Eighty-two percent of the sample is women and the mean age is 28 years. Again this correlates with the average nursing student population.

The research is a quantitative, quasi-experimental, two-group pretest/post-test design. Students are randomly assigned to either an HPS or ICS scenario that covers the same course content for all three nursing programs and the same subject matter; care of the patient with acute coronary syndrome and care of the patient with acute ischemic stroke. The evaluation instrument is a Health Education Systems, Inc. (HESI) custom examination. The researchers report validity of the HESI as predictive of nursing licensure exam success as well as validity in the nursing curriculum. The same pre and post test is administered to all students regardless of which group they are assigned to. Students also complete a survey to measure their perception of the educational intervention they received. Content validity of the survey is provided by a group of nurse educators who are content experts; the survey is also pilot tested with a group of five students. Internal consistency of the 4-point Likert scale is determined by Cronbach to be reliable.

Data is collected over a 6-month period. Variables are controlled by administering the tests for both groups at the same time of the day they receive their educational intervention and ensuring the procedure for conducting the study is identical for all students. Students in the HPS group view a 10 minute PowerPoint presentation on caring for the patient with acute coronary syndrome. They are then briefed on the nature of HPS followed by a 15 minute scenario where

they do a head to toe patient assessment, collect a patient history and provide required interventions. Students draw index cards to determine the role they will assume in the scenario (primary nurse, secondary nurse, family member or nursing assistant). A debriefing session follows where students review their videotaped simulation experience. After a 5 minute break, students repeat the HPS scenario on caring for the patient with ischemic heart disease. Total time for both HPS scenarios is 2.5 hours. The primary investigator is the facilitator for the HPS scenarios.

Students in the ICS group view the same PowerPoint presentations and are provided with nursing textbooks and copies of both case studies. They are to analyze the content through group discussion and answer the case study questions as a group. A debriefing session follows where the instructor provides additional guidance and teaching as indicated by the students' responses to the questions. The total time is approximately 2 hours. The primary investigator provided faculty orientation to the ICS instructional method.

Comparison of HPS and ICS posttest HESI scores showed a significant improvement in the HPS group compared to the ICS group. The average posttest scores for the HPS group increased by 3.49%, whereas the average posttest scores for the control group *decreased* by 17.32%. The researchers found these results confusing and determined it was a result of the passive learning nature of the ICS which could mean this group experienced more mental fatigue when the posttest was taken. Other reasons include a greater interest in the new technology of HPS and the fact that the faculty facilitators for the ICS group had less classroom experience. The results of the survey demonstrate that students preferred HPS over ICS for developing critical thinking, transferring knowledge to the clinical setting, providing a realistic learning environment and helping them understand concepts.

This study highlights the value of active, experiential learning, which is supported by the realism of HPS. Students are able to assume nursing roles in the HPS scenarios, something that is not evident from the description of the ICS. Students also learn vicariously by observing other students decisions and actions in the HPS scenarios. Both educational interventions potentially provide a safe environment to develop critical thinking and reasoning skills, especially if the facilitator is not a regular instructor for either group. The HPS design compares to the previous studies (Alinier et al. 2006; Blum et al. 2010) and includes a briefing to both the simulation experience and to the patient, scenario format and a debriefing.

Although the researchers state that faculties at the schools of nursing participating in this study were familiar with and used case studies provided by Elsevier nursing textbooks, they state that faculty and graduate students taking part in the ICS scenarios had little classroom experience. This may have resulted in the poor test results for the ICS group. Also, the primary researcher oriented faculty to the ICS instructional method. If the primary researcher facilitated the HPS and orientated faculty to the ICS, there should be consistency of learning objectives and goals for both groups.

Sample size compares to Blum et al. (2010), however the researchers find this sample size is a study limitation. There is no mention of an overarching theoretical framework guiding the study, but the HPS scenarios contain elements Jeffries (2005) identifies as important to good simulation design: fidelity or realism, clearly written objectives matching learners' knowledge and experience, and debriefing. There is a limited description of the complexity of the HPS scenarios but students have assigned roles that add to the realism of the experience. There is personal bias present as the primary investigator designed the scenarios and acted as the faculty facilitator for the HPS sessions.

Ironside, Jeffries, and Martin (2009). Another study rating 2.0 is “Fostering Patient Safety Competencies Using Multiple Patient Simulation Experiences”. The purpose of this study is to determine how the independent variables of multiple patient simulation experiences and student factors of age, GPA and tolerance for ambiguity affect the dependent variable of students’ patient safety competencies. The research questions focus on whether multiple patient simulation experience improves students’ patient safety competencies and the relationship between student factors and achievement of patient safety competencies (p.334).

In the Quality and Safety Education for Nursing (QSEN) project, the authors identify six competencies related to patient safety and quality care: patient-centered care, collaboration/teamwork, informatics, quality improvement, evidence-based practice and safety (p. 332). They define these competencies within the context of prelicensure according to the specific knowledge, skills and attitudes (KSAs) required by prelicensure nurses to demonstrate competency to practice. The researchers point out that a survey of 195 nursing program leaders to determine how these 6 patient safety competencies are incorporated into nursing curricula indicate that they were present, but faculty were unable to describe the pedagogical strategies used to teach them. I agree with the researchers that these findings highlight the need to develop new educational strategies for teaching patient safety and there is a “need for substantive reform in nursing education to address patient safety issues” (p. 333).

Jeffries’ Simulation Model (2007) is the conceptual framework for the study. This framework is the result of the work of a national group organized by the National League of Nursing in partnership with the Laerdal Corporation and is based on empirical and theoretical literature (Jeffries, 2005, p. 96). The model is intended to be used with all types of simulation (high or low fidelity) designed for use in nursing education. The model identifies essential

aspects of simulation design required to support desired student outcomes. The factors include: a) teacher factors, b) student factors, c) educational practices, d) simulation design characteristics and e) student outcomes. Student variables (program, level, age) are controlled by the purposive sample of undergraduate nursing students in their last semester. Student variables of tolerance for ambiguity and GPA are analyzed to determine their relationship to simulation outcomes. Teacher variables are controlled by providing faculty with detailed scenarios, guidance in conducting scenarios and help with evaluation of student performance. Educational variables are controlled through a common curriculum and scenarios between the sites. The simulation design and student outcome variables are consistent between sites.

The large purposive sample (n=413) is comprised of nursing students in their final semester of the program from 8 Indiana University schools of nursing, representing rural and urban campuses and baccalaureate and associate degree nursing programs. Demographic characteristics include 91% female with a mean age of 29 years. The overall GPA is 3.4 on a 4-point scale. Students volunteer to participate in the simulation experiences in lieu of clinical hours during regular class or clinical time during a 10-week management course (p. 334).

The method is a quantitative, quasi-experimental, pretest/posttest design. The simulation experiences occur at the same time in the course during weeks 3 and 4 and weeks 9 and 10. Students complete a Multiple Simulation Types Ambiguity Tolerance Scale-1 (MSTAT-1) and provide demographic data prior to the first simulation experience. Students complete another MSTAT-1 after the second simulation experience. Students choose the time to participate in the simulations in groups of 5 and performance bias is controlled when they are randomly assigned to roles. There are two faculty members present for each simulation; one evaluates student performance for patient safety competencies and the other plays the role of physician, nursing

supervisor etc. as required to support learning intentions. The research team develops four scenarios that mimic the “volume and complexity of patients typically assigned to a nurse new to practice...” (p. 335). Performance bias is controlled as students complete different scenarios for the first and second simulation, which controls performance bias. Design features found to be important for improving learning outcomes include a briefing of the logistics of the simulation, a report of the patients’ status, and a 20 minute scenario followed by a 20 minute debriefing (Jeffries, 2005). To meet the criteria of the study to determine the relationship between student factors and students’ patient safety competencies, ambiguous or missing information is provided prior to and throughout the scenario. In addition each scenario includes a major disruption to evaluate prioritization of care and each scenario requires the student to give a report to a physician or a nurse. This is the first study on students’ caring for multiple patients, mimicking the complexity of the workplace.

There is no description of the simulation to indicate the fidelity of the mannequins. Although this study does not meet my inclusion criteria for simulation fidelity, I have included it because it is based on the Jeffries Simulation Model and is concerned with developing students’ patient safety competencies, which is identified as important for pre-licensure nursing competencies. The researchers suggest that students’ performance related to specific competencies can be evaluated when scenarios are constructed to test specific aspects of clinical practice; in this study it is patient safety (p. 333).

The MSTAT-1 is the evaluation instrument used to measure ambiguity tolerance and “assess an individual’s cognitive orientation toward making judgments in the absence of desired situational information” (p. 335). The internal consistency of this instrument for this study is rated as acceptable (Cronbach’s alpha = 0.86). Investigators evaluate students’ safety

competencies using an investigator instrument based on 16 KSA criteria for the Quality and Safety in Nursing project (p. 335). Four-hundred thirteen students complete both MSTAT-1s, sixty-seven of whom are evaluated in the primary nursing role for patient safety competencies. As only one sixth of the students are represented in the study, participation bias is present. One-way ANOVA tests and Fisher's exact tests compare student factors across the four simulation scenarios to verify random assignment. Paired *t*-tests measure improvement in student safety competencies between both simulated experiences. Correlations between student factors, MSTAT-1 scores and the outcome variable of patient safety variables are compared. Pearson *r* correlations confirmed no significant relationship between any student factor and the achievement of patient safety competencies.

The initial hypothesis that student achievement of patient safety competencies will improve with experience in multiple-patient simulations is supported in the test results. However, we could argue that students' patient safety competencies could improve as a result of practice and a result of clinical experience. The second hypothesis, tolerance for ambiguity increases with exposure to simulation, is not referred to in the study findings. Instead, the researchers find no correlation between student factors and the students' attainment of patient safety competencies. I agree in the value of incorporating elements of ambiguity into simulation scenarios to mimic the reality of the clinical environment. In this study the authors demonstrate the value of including multiple patient scenarios prior to students entering practice, as they often do not have that experience in their clinical rotation. With the current reduced staffing levels and ratio of experienced to inexperienced staff, providing students with opportunities that resemble clinical situations is crucial. This study benefits from using the Jeffries Simulation Model and controlling variables related to student, teacher, simulation design, educational practices and outcome

factors. It is sobering to observe that university faculty believe their students meet the criteria for patient safety competencies but faculty are unable to identify the pedagogical strategies used to teach them. Faculty members agree that they do not have the expertise to integrate this content into the curriculum and identify the need for more pedagogical tools to make changes to the existing curriculum (p. 333). This study shows that simulation can be used beyond teaching technical skills and crisis intervention to expose students to experiences they will encounter when caring for multiple patients, where organization and prioritization, collaboration and teamwork and the ability to effectively use resources is necessary.

Kardong-Edgren, Starkweather and Ward (2008). “The Integration of Simulation into a Clinical Foundations of Nursing Course: Student and Faculty Perspectives by Kardong-Edgren, Starkweather and Ward” (2008) is the fourth study rating 2.0 for methodological and theoretical rigour. The study design involves three simulation scenarios based on the Jeffries Simulation Model (2007), to compare student and faculty perceptions of the simulation experience using tools developed by the National League of Nursing (NLN). The independent variable of simulation scenarios linked to didactic content affects the dependent variable of student learning and acquisition of clinical skills, and faculty perceptions of the simulation implementation process.

Jeffries’ (2007) Nursing Education Simulation Framework is the theoretical framework used to guide the design of the scenarios. The framework links concepts of educational practices, the teacher, the student, the design characteristics of the simulation, and learning outcomes. Additional concepts of active learning, diverse learning styles, collaboration, and high expectations are hallmarks of this framework (p. 3). Jeffries (2005) acknowledges that a

“consistent and empirically supported model to guide the design and implementation of simulation and to assess outcomes” is important by nursing and medical educators (p. 97).

The convenience sample consists of 100 undergraduate nursing students enrolled in their first clinical course. The researchers do not divide the sample into a control and intervention group. Their intention to provide equal opportunities to all students and support the primary focus of the study, which is to have students and faculty evaluate how HPS supports clinical skill development. Demographic characteristics of the sample are representative of undergraduate nursing students and are 84% female with a mean age of 24 years. The authors report that 75% of the participants are Anglo. Faculty have various levels of experience with facilitating HPS and all have a Master’s in Nursing preparation.

The authors describe the mixed method ?study as being a prospective, descriptive, repeated measures design intended to evaluate three faculty-written simulated scenarios. These scenarios are rated by students using scenario evaluation tools designed by the Laerdal NLN Study Group. Students rate the scenarios for educational practices (active learning, collaboration, high expectations and diverse ways of knowing), simulation design, and satisfaction and self confidence in learning. Content validity for the evaluation tools is established by an expert nursing panel and internal validity is confirmed with Cronbach’s alpha as reliable. The HPS scenarios are tested prior to use for timing and to reinforce faculty facilitation skills. This practice along with having an experienced faculty mentor available supports the implementation process.

Scenarios are written by faculty in a scaffolding manner to match the skills expected of nursing students in the clinical setting. Content includes skills that students consistently find difficult to learn in their first clinical experiences. The clinical foundations course, on which the

scenarios are based, focuses on assessment, treatment and nursing knowledge. Faculty incorporates these learning objectives-into each scenario. The design of the scenarios provides students with a safe venue to consolidate skills and develop interpersonal communication and psychosocial skills. Students are required to maintain CPR certification and faculty choose to include this skill in the final scenario. The researchers identify that repetitive practice of skills planned into the scenario reinforce skill development by integrating psychomotor and psychosocial skills through deliberate repetition. Jeffries (2005) suggests that “procedural skills are receiving increased attention because of their importance to patient care and the more rigorous competency standards required by national organizations...and certification groups” (p. 102). Providing undergraduate nurses with CPR training in a simulation lab provides a new graduate registered nurse with the confidence and knowledge to lead a code successfully (personal communication Dr. R. McGraw, MD, FRCPC, Associate Professor, Queens University, Dept. of Emergency Medicine, June 26, 2010).

Apart from content, the simulated scenarios are similar to the previous studies in that they introduce students to the concept of simulation and include a patient briefing, a 15 minute scenario followed by a 15 minute debriefing session. A Laerdal medium fidelity mannequin is used to simulate the patient and students are divided into groups of five with randomly assigned roles. Educators facilitate the learning and cue students to reinforce learning objectives. Students are expected to complete pre-reading and to arrive dressed for the clinical environment wearing uniforms and carrying stethoscopes. This adds to the realism of the scenario. Students complete three questionnaires at the end of each session rating educational practices, simulation design, and satisfaction and self confidence with learning. Faculty members provide qualitative data by

completing a feedback form after each simulation. Responses are analyzed to identify general themes.

Students are very supportive of the simulation experiences and rate the design elements, identified educational practices and their satisfaction and self-confidence highly. Faculty report that the multi-tasking required to run the simulation, to facilitate learning and to contribute effectively to the debriefing sessions is challenging. In other words they identify a steep learning curve until they feel comfortable with the change in pedagogy. Not all faculty rate the experience as being superior to other forms of teaching and evaluation but the majority of educators approve of it as a method to be incorporated into the curriculum. Of note students pass the paper and pencil exam “for the first time in collective memory” (p. 13). The researchers suggest that this occurrence could be attributed to exposure to the simulated learner, however this may be a premature conclusion and they recommend more observation and study.

This study is a description of one university’s experience with incorporating HPS into an undergraduate nursing program after expensive simulation equipment sat idle for over a year. Leigh and Hurst (2008) maintain that incorporating simulation into a nursing curriculum is not an easy task; they suggest identifying a “champion” to act as a change agent and motivate staff to adopt new technology into the nursing curriculum. This is especially important when there are minimal perceived advantages when comparing learning outcomes between conventional methodologies and HPS. Faculty members’ responses reinforce the notion that there is a steep learning curve required of nursing faculty before they feel comfortable using the technology.

The sample size is adequate, especially when it isn’t divided into a control and intervention group. This study reinforces what was learned in the multi-site Laerdal NLN study and benefits from using the Nursing Education Simulation Framework, which is empirically and

theoretically based. The majority of references are within 5 years of publication of the study. Performance bias is present due to the variation in experience that faculty had with facilitating HPS scenarios, especially the debriefing aspect. These researchers find that students are satisfied with the design of the HPS and the teaching/learning modality. The researchers' findings corroborate the literature that there is a steep learning curve involved with incorporating HPS into the nursing curriculum.

Kuiper, Heinrich, Matthias, Graham and Bell-Kotwall (2008). The fifth study rating of 2.0 is "Debriefing with the OPT Model of Clinical Reasoning During High-Fidelity Patient Simulation". The purpose of this study is to analyze the influence of HPS on the cognition of undergraduate nursing students. Specifically, the study is designed to compare the clinical reasoning activities surrounding HPS with authentic clinical experiences. The authors also hope to determine if the OPT model of reasoning could be used as a method of debriefing following HPS.

The authors identify Bandura's (1977) Social Cognitive Theory as the theoretical framework guiding the study. Students' belief in their ability to learn determines their aspirations, level of motivation and academic accomplishments. Also, teachers' beliefs in their ability to motivate students affect the type of learning environments they create. Using this theory, teachers should develop simulated scenarios to ensure that learners are actively involved, and reinforce behaviors that lead to desired outcomes. Debriefing is an important aspect of HPS and applying social cognitive theory provides structure that guides the reflective learning process. Petranek et al. (1992) suggest that, "if the debriefing is unstructured, the responses may be at various cognitive levels and incorrectly applied to authentic experiences" (cited in Kuiper et al. 2008, p. 2).

A purposive sample of 44 senior undergraduate nursing students enrolled in an adult health medical/surgical course is chosen for this study. Demographic characteristics of the sample are consistent with the average student population: 89% female with a mean age of 22 years. The students have no previous experience with HPS apart from task trainer exercises and 98% are Caucasian. Students are expected to complete five to six OPT worksheets following authentic clinical experiences. The clinical experience is 14 weeks in length and students rotate out of the clinical setting at various times to spend four hours completing a HPS scenario and debriefing. Students complete one OPT worksheet following the HPS session.

The clinical experience is a 10 hour shift where students assess, plan and care for one patient on an acute medical/surgical ward. Students use the OPT worksheets to develop a plan of care and identify a keystone issue related to the patients' condition. The worksheets are started during the clinical experience, completed independently and handed in to faculty within a week of the clinical. Faculty rate the worksheets using the OPT rating tool and provide feedback to guide clinical reasoning and ensure students meet the learning goals. The OPT worksheets with the highest scores for the clinical experience are compared to the OPT worksheets used with the HPS. The researchers indicate the rating tool has been used by researchers since 2003 and the inter-rater reliability is 87% between two clinical instructors for a random selection of OPT worksheets (p. 5).

The HPS scenarios consist of a case study, list of lab values and potential list of medications. Learning intentions are identified in the scenario to guide instructors; e.g. respiratory rate of 30 prompts student to elevate head of bed. There is no description of simulation design, assignment of roles, size of group or length of simulation. Students work as a group rather than alone to assess, plan and intervene in the care of the simulated patient. The

worksheets are used to guide the debriefing process. Students identify the medical diagnosis and keystone issue and complete the OPT worksheets independently within 3 hours of the simulation experience. Students collect qualitative data regarding their simulation experience and identify the major themes.

Comparison of test results for the two groups shows no significant difference in the mean scores: the average group score is 62%. Paired *t*-tests compared scores for each section of the OPT model show no significant difference between the clinical or simulation experiences. The researchers find that the clinical reasoning activities of the HPS prompt students to think on the spot and solve problems independently, which develops clinical reasoning skills they will use in authentic clinical practice.

Although the study has participation bias due to the size and homogeneity of the sample, it supports the use of simulation in nursing education for skill development, collaborative relationships and developing clinical reasoning activities that transfer to the work environment. The fact that there was no difference in clinical reasoning scores between HPS and authentic clinical experiences may indicate that students' clinical reasoning in HPS builds on the clinical reasoning activities developed in caring for patients in the actual clinical setting. There is no discussion on the design of the HPS scenarios or if they compared to patient characteristics in the clinical setting. However, the researchers indicate that HPS scenarios should coordinate with course content and clinical experiences to reinforce learning outcomes. They suggest that simulation could be used for student remediation, student evaluation and curriculum evaluation.

The differences in experience between the HPS and clinical sessions result in different clinical reasoning activities. The HPS is more dynamic than the actual clinical experience and supports experiential learning and includes aspects of team work, leadership and group

dynamics. In contrast students work more independently in the actual clinical and rely on their mentor for guidance regarding clinical decisions.

Ravert (2008). Patricia Ravert's (2008) study, "Patient Simulator Sessions and Critical Thinking", is the seventh one to rate 2.0 for rigor. The purpose of this study is twofold; first to compare the effects of three independent variables (regular education process plus HPS, regular education process plus case study and regular education process with no enrichment sessions) on the dependent variables of critical thinking disposition and critical thinking skill, and secondly to determine how critical thinking is moderated by preferred learning style. There is an emphasis on active learning strategies in nursing education because it fosters critical thinking and problem-based learning that is an important part of clinical nursing practice (Young & Paterson, 2007). Preferred learning styles vary from passive and reflective to active and tactile, and participants' experiences with simulation may be influenced by their learning style. Brazen and Roth (1995) suggest that the efforts of the most expert educator, using the most advanced teaching strategies, will not succeed with all learners as they (learners) process information differently. Therefore educators who understand different learning styles should develop student-focused pedagogies to successfully cultivate learning in all learners.

Kolb's (1999) theory of experiential learning and his learning style inventory is the conceptual framework for this study. HPS supports active learning pedagogies such as experiential learning. Kolb (1984) believes "learning is the process whereby knowledge is created through the transformation of experience" (p. 38). The cyclical model consists of four stages (concrete experience, reflective observation, abstract conceptualization, active experimentation) and one may start at any stage but continue in sequence. Kolb (1999) developed an assessment tool to determine a person's preferred learning style. Hartman (1995)

suggests that a person's preferred learning style may influence performance in individual or group learning positively or negatively (cited in, Ravert 2009, p. 558).

A convenience sample of 2 cohorts of 64 undergraduate nursing students enrolled in the first med/surg nursing course following a fundamentals in nursing course are invited to participate in the study. Twenty-five students from the first cohort volunteer to participate and are divided into 2 experimental groups. Fifteen volunteer students from the second cohort make up the control group. The demographic makeup of the volunteer sample (n=40) is 99% female, majority Anglo with a mean age of 22 years. The students' mean GPA is 3.65 on a scale of 4.0. The sample is comprised of 65% senior students and 35% juniors. All students are enrolled in a private university.

The quantitative study is a pretest/posttest design with the sample divided into three cohort groups: 2 experimental groups and one control group. The control group participates in the regular education process with no enrichment session. Both experimental groups participate in the regular education process, however the non-HPS group has additional five case study sessions and the HPS-group has five simulated enrichment sessions. Each enrichment session is a weekly, one hour session. Participants in the experimental groups also consent to audio taped and transcribed interviews at the end of the study. Each participant's critical thinking is measured prior to the start of the study and after the enrichment sessions are completed (p. 559).

The California Critical Thinking Disposition Inventory (CCTDI), the California Critical Thinking Skills Test (CCTST) and Kolb's Learning Style Inventory (LSI) are the instruments measuring critical thinking disposition, critical thinking skill and preferred learning style. The CCTDI is a 6-point Likert scale (agree-disagree) format. It measures participants' disposition in seven concepts: truth-seeking, open-mindedness, analyticity, systematicity, critical thinking self-

confidence, inquisitiveness and cognitive maturity. The CCTST is a 34-item multiple-choice instrument that measures core critical thinking skills of evaluation, analysis, inference, and deductive and inductive reasoning. The LSI uses a sentence completion format to measure preferred learning style. Cronbach's alpha provides internal consistency for all instruments and reliable. Data analysis was performed using SPSS, version 11.5 (p. 560).

Overall, critical thinking scores of disposition and skill increase for all groups. There is no statistical difference between the groups due to the small sample size and the inherent limited power to detect differences (p. 560). The researchers suspect that critical thinking may have been influenced by maturation and time in school rather than the result of the enrichment activity. This is believable as there was a 5 weeks delay between tests. The hypothesis that learning style would be a moderating effect to student learning is not proven. The HPS experimental group find the high-fidelity simulated session to be very realistic, however the majority of students in the enrichment sessions state they would not attend unless it was required. The researchers suggest that students should have been given the option of which group to attend and would make their choice based on their preferred learning style.

This is an interesting study in that the authors consider students' preferred learning style along with the effects of the enrichment sessions on critical thinking. It is disappointing to learn that only an average of 31% of students volunteered for the study; hence participation bias affects the results. Critical thinking is difficult to measure and the researchers state that critical thinking disposition is an ingrained trait and difficult to change over time. The researchers identify a number of limitations such as small sample size, homogeneity of sample, high GPA, sample mean younger than mean age of students. The other limitations include potential contamination between groups of students who attended classes and clinical experiences

together, and the fact that both experimental groups received more personalized time to have questions answered. Also they addressed the fact that HPS is not a real patient and some student factors and conditions are difficult to simulate. The researchers suggest that the critical thinking instruments may not relate to the profession of nursing.

The most common learning style of the participants is a converger. Goldrick, Gruendemann and Larson (1993) state that studies have shown nurses tend to be accommodators or divergers who learn better in concrete feeling-oriented situations. They also cite Kolb (1984) as suggesting that members of a profession adapt their learning style to the predominant learning demands of the respective discipline (p. 178). If this is true, how important is preferred learning style to learning if it adapts with experience as Kolb suggests? I suggest that the benefits of HPS to recreate the clinical environment, along with the ability to support student learning in a safe environment that allows them to make mistakes without repercussions to either the student or patient is paramount. Educators need to prepare students for the complex clinical environment in which they will be working.

Sinclair and Ferguson (2009). The last study rating a 2.0 is “Integrating Simulated Teaching/Learning Strategies into Undergraduate Nursing Education”. The purpose of the study is to assess students’ perceptions of self-efficacy by comparing two groups of students: the control group is exposed only to lecture in their nursing theory course and the intervention group is exposed to a combination of lecture and simulation. The authors choose Bandura’s (1977, 1986) self-efficacy theory as the conceptual framework because students frequently feel anxiety in the clinical environment, which may limit their ability to transfer theory to practice. The authors develop the causal link between Bandura’s (1977, 1986) theory of self-efficacy and

simulated learning activities. They identify basic concepts of the theory, such as our belief in the likelihood of success, influences our motivation to engage in activities.

The authors also identify that expectations of self-efficacy are derived from four sources of information: performance accomplishments, vicarious experience, social persuasion and physiological and emotional states (Bandura, 1977). Therefore they suggest the simulations allow students to apply theory to practice and develop competence in dealing with specific situations. This in turn allows them to improve their ability to transfer this knowledge to the clinical setting. The authors identify realism as an important component of simulation; this idea is supported by Jeffries (2005, 2007) as an important aspect of simulation. “They (simulation scenarios) must be authentic and include as many realistic environmental factors as possible” (Jeffries, 2005, p. 101).

Vicarious experience is gained by observing others perform activities successfully, which influences the belief in one’s capabilities. Coaching and giving evaluative feedback to students participating in simulated learning activities leads them, through suggestion, into believing that they can cope successfully with specific tasks. The authors suggest this social persuasion may promote more meaningful learning and reduce anxiety that students often experience in the clinical setting. Bandura (1977) suggests that emotional reactions to specific tasks (e.g. anxiety) can lead to negative judgments of one’s ability to complete tasks. The research question is: What is the effect of an educational strategy that combines classroom and simulated learning activities on nursing students’: a) perceptions of self-efficacy for nursing practice, and b) satisfaction, effectiveness and consistency between their learning styles and the intervention?

The authors draw on a convenience sample of second year undergraduate nursing students in a collaborative university/college setting in Ontario chosen from each of two sites:

the control group is located at one site and the intervention group is at the other. The sample size is larger than most studies, $n=250$, however the response rate is low at 33% for the control group and 34% for the intervention group. Demographic characteristics of the sample are 95% female with a mean age of 22. Ninety-nine percent are enrolled full time and 21% have previous health care experience.

The research is a mixed method, experimental design using both quantitative and qualitative data. The education intervention was embedded in a required second year theory course, Complex Health Challenges, with a companion clinical course. Students volunteer to complete questionnaires and reflective activities. The control group is exposed to theoretical lecture content on five topics pertaining to episodic health challenges across the lifespan for a total of ten hours. The intervention group receives five hours of lecture content, and five hours of simulated learning activity on the same types of health challenges. The simulated activity takes place in a nine bed simulation lab utilizing medium fidelity mannequins. Students are required to do a patient assessment, prioritize care, experience two nursing interventions and evaluate client care. Apart from describing the size of the student groups in the simulated learning scenarios and the length of the debriefing, there is no mention of how the simulated scenario is conducted, i.e. what role each student takes and how that affects self-efficacy. There is no discussion of what is omitted from lecture content for the intervention group. There is mention that educators facilitate learning by prompting students as the simulated scenario unfolds.

Quantitative data consists of a demographic questionnaire, a self-efficacy questionnaire and a satisfaction questionnaire. Qualitative data is collected from reflective reviews submitted by 12 students. The primary variable of self-efficacy is operationalized using a modified version of the Baccalaureate Nursing Student Teaching-Learning Self-Efficacy Questionnaire (Goldberg

et. al, 2005) administered pre and post lecture or simulation activity. Students rate their self-efficacy on a scale from “not confident at all” to “very confident”. The original instrument has a reliability of 0.97 using Cronbach’s alpha. Two educators rate the modified tool for content validity, however reliability is not determined; this may be the first time the Self-Efficacy Questionnaire has been used in a simulation learning situation.

The secondary variable of satisfaction, effectiveness and consistency with learning style is operationalized with the researcher-developed satisfaction questionnaire and reflective reviews. Both groups voluntarily complete this questionnaire after each lecture or simulation activity. Effectiveness, satisfaction, and consistency with learning style were rated using a Likert scale in the satisfaction questionnaire. Questions focused on the articulation of expectations related to the learning activity, time provided for questions, realism of the learning activity and congruence of the learning activity to individual learning style. This tool was based on a review of the nursing literature related to simulation and the researchers’ own teaching experiences. Reflective reviews are submitted by the intervention group after completing each of five simulated activities (College of Nurses of Ontario [CNO], 2005). Data analysis is summed up in three sentences and includes the use of t-tests, a reflective analysis for themes and a comment that responses to open-ended questions are reviewed by the researchers and common responses identified (p. 5). Percentages are used to analyze the satisfaction questionnaires.

Themes are identified through a qualitative analysis of reflective reviews submitted by the intervention group. The authors report that voluntary completion of these reviews was limited to 12 students; however they do not indicate the reasons for this decision. The authors note that although a significant number of students attended lectures and simulated learning activities, the response rate for questionnaires was low. They suggest fatigue and time demands may be a

factor. This is too small of a group and I would suspect participation bias due to the low response rate, which is even smaller than the response rate for self-efficacy and satisfaction. However, the identified themes are consistent with what is found in the literature. The authors identify the most common themes relating to the simulated learning activities were peer learning opportunities, reinforcement of knowledge and improved confidence (p. 7). Students valued the ability to gain knowledge and experience in the simulated scenarios and to learn from each other. Leigh (2008) finds simulation enables students to be more confident in performing clinical work. Arundell and Cioffi (2009) contend that didactic content is directed at passive recipients of knowledge and “this style of teaching does not foster their decision-making skills” (p. 296). Students in the control group requested more “creative interactions” and “different teaching methods besides power point” and more opportunity for active learning strategies. This observation is supported by Jeffries (2007), who suggests students lose interest in the educational experience without active involvement (p. 25). These themes are supported by Bandura (1977, 1986) who contends a students’ prior knowledge is an important foundation to integrate new knowledge and vicarious learning is an important source of information (Sinclair and Ferguson, 2008, p. 8).

This Canadian study is reflective of the simulation literature that advocates for active learning strategies and new ways of preparing nursing students for a complex healthcare environment. Some questions I have after critiquing this study are related to the design of the simulated learning scenarios. Readers are not provided with enough information regarding the research design. It would be advantageous to understand how the simulation was conducted, what lecture content was omitted in the intervention group and how roles were assigned in the simulation scenario. The authors indicate that as a result of this study, combined lecture/simulated learning activities are now a regular part of the theory course at the

intervention site. While the authors identify a theoretical framework guiding the hypothesis, they do not indicate one for the design of the simulation.

Studies that Rated a 1.0

Lasater (2007). Three studies rated 1.0 for methodological and theoretical rigour: Lasater (2007), Limoges (2010) and Radharkrishnan, Roche and Cunningham (2007). The purpose of Kathie Lasater's (2007) "High-Fidelity Simulation and Development of Clinical Judgment: Students' Experiences" is to examine the effect of students' experience with simulation (independent variable) on the development of clinical judgment (dependent variable). Lasater identifies that although simulation programs are opening up across the country, there is little research to support this trend. She states the factors driving this trend are the reduction in clinical experience required to support consistent Practica experiences and the need to develop higher levels of critical thinking to prepare professional nurses for the complex healthcare environment. Alinier (2006), Feingold, Calaluce, & Kallen (2004) and Jeffries (2005) support this sentiment.

The realism provided by high-fidelity simulation mimics the clinical environment and allows educators to evaluate students' critical thinking and skill development. However, Lasater suggests there is an absence of research showing that clinical judgment is supported by simulation. This study describes one part of a 2004 study that examined the interaction between the four dimensions of clinical judgment development: a) students' description of their confidence in their clinical judgment skills b) students' aptitude for critical thinking c) students' experience with simulation as communicated through a focus group and d) qualitative descriptions of students' clinical judgment during simulation. The findings from the perspective

of student experiences from the first term that HPS is embedded in the nursing curriculum at the Oregon Health and Science University are the basis of this study.

Lasater identifies some common themes found in the simulation literature, namely, the interactive nature of simulation motivates students, the value of active learning, the opportunity to develop skills in a safe environment and the student-centered and constructed nature of learning that occurs in simulation. However, Lasater does not agree that simulation will replace “real contextual human patient care experiences” (p. 270).

The population consists of 48 junior level students enrolled in a Nursing Care of the Acutely Ill Adult course. The researcher observes thirty-nine students and invites them to participate in the study. Neutrality is provided in choosing the purposive sample as the author/observer has no instructional or evaluation responsibilities and only 15 students volunteer. Ninety-nine percent of the sample is female with a mean age of 37 years. The researchers define traditional students as being younger than 24, female, white and having no previous degree. The 39 observed students fall into the nontraditional definition of having one of the following attributes: either being older than 25, male, having a previous degree, or of a racial/ethnic minority. Therefore participation bias is present and potentially biases the findings.

Morgan’s (1997) principles for focus group facilitation is the conceptual framework used for the observations. The 90-minute focus group sessions take place in the simulation laboratory and are video taped for analysis. The facilitators stimulate discussion with predetermined questions and use open-ended questions to clarify student comments. Qualitative data analysis is retrospective and is guided by a framework (Marshall & Rossman, 1999). The use of conceptual frameworks provides rigor in group facilitation and data analysis. The researcher identifies initial categories and pertinent student comments immediately following a focus session. Thirteen

primary themes are identified by reviewing the audiotape in conjunction with re-reading of notes. Credibility of the study is evident as the researcher condenses the themes into 5 major codes that match 95% of the students' responses.

The five codes include: a) strengths and weaknesses inherent in high-fidelity simulation, b) the paradoxical nature of simulation, c) student identified desire for focused feedback on their performance, e) the value of students' relationship with others and f) recommendations for better facilitation and learning. Students reported that simulation served as an "integrator of learning" to assimilate theory and psychomotor skills learned from clinical practice in a way that made them critically think what to do (p. 272). Students value the realism afforded in simulation and appreciated the instant feedback of their interventions with the mannequin (patient). Debriefing is also highly valued by students as a way of clarifying concepts that may have been missed or not understood in the readings. Students develop "breadth of experience" by being introduced to situations they hadn't encountered before in the clinical experience; scenarios force them to anticipate what could happen in the clinical setting. The lack of realism in simulation is a limitation that students identify when the voice of the mannequin is only female, when there is no visible or nonverbal communication, and when certain types of assessments are not possible (e.g. neurological reflexes).

Students verbalize the paradox of having increased anxiety as well as increased awareness. However they understand the low-risk nature of the simulation and the fact their "patient" can't die. Students feel vulnerable in the primary nurse role, however they are able to verbalize in the debriefing what they learn from the experience and how they can improve their performance. The critical reflection occurs in the debriefing process and confirms the value of

simulations to support clinical judgment and reasoning. Students remark that most learning occurs from negative “trigger events” (p. 273).

Students identify a desire for constructive, focused feedback regarding their actions, even if it isn't positive. “I would have benefitted from knowing the shortcomings of my choices” was one comment (p. 274). Students identify in the focus groups that vicarious learning is a valuable part of simulation. Students work independently or under the guidance of their instructor in the clinical setting and do not have to opportunity to learn from other students. Narrative learning, hearing stories from other students and instructors, was identified as valuable. Tanner (2006) suggests that narrative reasoning creates a background understanding of the patient as a person and the nurses' actions can only be understood in that context.

This study is valuable in increasing knowledge of simulation use in nursing education by providing students' impressions of the HPS experience. The findings in this study validate the use of debriefing to improve critical reflection and to provide “structured observation” for students observing the actions of their fellow students. Mezirow (1990) identifies that critical reflection stimulates learners to reassess how problems are posed and solved through actions and feelings (cited in Lasater, 2007, p. 274) and this process is apparent in the debriefing procedure. As participation bias is present in this study, further research would be required to demonstrate the same student reflections in a larger, more diverse population of nursing students. This view is supported by Jeffries (2007) and Kardong-Edgren et al. (2008), who believe that simulation supports diverse learning needs. Lasater suggests that nursing programs should use focus groups annually “to ensure the goals of simulation are matching students' perceptions” (p. 275).

Limoges (2010). The second study rating 1.0 for rigour is “An Exploration of Ruling Relations and How They Organize and Regulate Nursing Education in the High-Fidelity Patient

Simulation Laboratory”. This qualitative study is an exploration of discourse and discursive practices that organize simulated learning, especially as it relates to nursing practice and knowledge. Smith’s (1987, 1990, 2005, 2006) institutional ethnography is the theoretical framework used, which focuses on “textual forms and practices of knowledge that organize those work processes” (p. 58). The author identifies that ruling discourses of biomedicine, efficiency, and relational ontology dismiss nurses’ distinct body of knowledge for their own purposes. The author suggests that conceptual frameworks guiding simulation use in education ignore nursing epistemology. The author agrees with Leigh (2008) and advocates for further research into the role that simulation makes to nursing pedagogy. The purpose of this study involves three areas of exploration deemed to be problematic to nursing pedagogy. The first issue is to review simulation literature and interview practical nursing and baccalaureate nursing students, along with nursing faculty to identify the discourses involved in simulated learning. Secondly, the purpose is to expose sources of power to identify how hierarchies are developed and maintained in simulated learning. Lastly, Limoges hopes to encourage discursive practices that reflect nursing’s contribution to patient care.

Nine faculty, five undergraduate nursing students and four practical nursing students make up the sample. Study participants are from a Canadian school of nursing with a philosophy that underscores the value of caring and human sciences on nursing epistemology. Students leave their clinical rotation at an acute care hospital to participate in small group learning in the simulation lab. There is no mention of demographic characteristics such as age, ethnicity, GPA or previous experience with simulation. There is no mention of ruling discourses and hierarchies found in the nursing school, for example the relationship between baccalaureate and practical

nursing students and how that is operationalized in the ruling nursing discourse reflected in nursing knowledge.

In the institutional ethnographic study the author invites volunteers to participate in the study. Students participate in simulated learning activities over a period of 2 to 4 days. The only description of the simulation lab experience is that high-fidelity mannequins are used “to replicate scenarios involving patients, families and inter-professional healthcare providers” (p. 60). There is no description of the design characteristics such as complexity, length of simulated experience, number of students per session and roles assumed or debriefing in the report. Learning objectives include development of skills and confidence in clinical judgment in a safe, controlled setting. Students repeat procedures as often as necessary and student-centered learning is emphasized.

Qualitative data is analyzed using NVIVO software (QRS 1999-2002). The author focuses on themes she is looking for by observing the HPS sessions and reviewing the interviews. There is no description of how and when the interviews are conducted, or the length of time required to complete them. Further, there is no description of the role of faculty with simulation or if simulation is embedded in the nursing curriculum. However, credibility is evident when the author states that “textual practices” (Smith 2006) and “ideological circles” (Smith 1990) are observable during the interviews (p. 61). An example provided, is where faculty refer to the simulation literature to support evidence-based decisions on the organization of the simulation lab. The author makes the observation that the simulation lab is popular with students and is a valuable marketing tool used to increase student enrollment.

The researcher identifies the ruling discourses of biomedicine and industrial/efficiency associated with the hospital setting. This is a valid observation. However, professional nurses are

expected to have assessment skills and provide interventions in a caring, patient-focused manner. One faculty member believes that students develop clinical skills in the simulation lab and as a result are able to spend more time in relation with their patient. Scenarios are scripted in such a way that students not only develop clinical skills but also consider the relational aspects of nursing and diverse ways of knowing. I do not believe that caring can be removed from patient care, regardless of the complexity of the environment.

Faculty members verbalize the discourses of resistance by questioning the philosophy of teaching students how to deal with uncertainty and ambiguity when the outcomes and answers are known. Ironside et al. (2009) contrasts this belief by intentionally providing elements of ambiguity or missing information into simulation scenarios to support the development of nursing patient safety competencies. I suggest that faculty would benefit from using this teaching strategy in the design of their simulation scenarios. Faculty members also believe there is a disconnect between the school's philosophy of nursing and the technical nature of HPS, especially as it relates to situated learning.

Nowhere in this study is there description of how students are prepared for their clinical experience, especially with how to deal with medical knowledge of their patients. This study adds to nursing simulation research and supports the need for further research into using simulation to support nursing students' development of relationships between each other and with the patient. Therapeutic nurse-patient relationships and individualized care are evident in acute care nursing, however, nurses also require psychomotor skills and knowledge of disease processes to care for patients. Simulation must be guided by pedagogies that address the complex nature of nursing knowledge and its integration into practice. This study adds to qualitative research and is guided by the work of Smith (1990, 2005, and 2006) in institutional ethnography.

It is important that we recognize the discourses of biomedicine and efficiency and continue to develop a body of knowledge that is nursing specific. Tensions arise when the school of nursing philosophy is not in synch with the needs of the clinical environment. Nurses must identify and support medical knowledge while providing nursing care. The expectation is that nurses are efficient and that often does not leave them time to develop relationships with their patients. HPS is very technical and nurses spend more time learning task related skills; hence Limoges points out the dominance of the biomedical model inherent in the design of HPS.

Radharkrishnan, Roche and Cunningham (2007). The last article rating 1.0 is “Measuring Clinical Practice Parameters with Human Patient Simulations: A Pilot Study”. The purpose of this study is to identify the dependent variables of clinical performance influenced by the independent variable of HPS exposure. A second purpose is to identify clinical practice parameters of safety, basic assessment, prioritization, problem-focused assessment, interventions, and delegation and communication that are influenced by simulation practice.

The conceptual framework guiding the research design is that HPS is an effective method of improving the competence of novice nurses, which is manifested in improved patient safety competencies and reduced healthcare costs. The framework is based on Ravert (2008) who proposes that simulation mimics the reality of the clinical setting. In their research, Feingold et al. (2004) found that students involved in HPS did not believe that learning would transfer to clinical situations. Chopra questions this belief and their research proves anesthetists who trained on an HPS performed better in crises (cited in Radharkrishnan et al. 2007, p. 2). Morgan and Cleave-Hogg (2000) support competence in psychomotor skills and found an anesthesia simulator reliable to assess medical students’ performance (cited in Radharkrishnan et al. 2007, p. 1).

The researchers choose a convenience sample of 35 senior undergraduate nursing students enrolled in a senior capstone course for the study. They invite twenty of this sample to participate and a convenience sample of 13 is finally chosen. The final sample size (n=12) is too small to provide reliable data, especially when they are randomly assigned to a control or an intervention group. No other demographic data is provided pertaining to age, ethnicity, or GPA. The control group completes clinical requirements and the intervention group does the same and also participates in two 1-hour complex HPS sessions involving two patients. At the end of the semester both groups complete a complex, 2-patient HPS scenario. Identical clinical practice objectives are evaluated for both groups.

The simulation design mimics the clinical experience; students receive a report on each patient including Drs' orders and patient history. Students assess and prioritize nursing care as if in an actual hospital room. A debriefing session follows the simulated learning. There is no description regarding number of students per HPS, assigned nursing roles, length of HPS or length of debriefing. The research team develops 2 variations of a clinical simulation involving 2 patients, one of whom develops a medical emergency.

Faculty assesses students in both groups using the Clinical Simulation Evaluation Tool (CSET). For every observed behaviour students receive points. An example of this tool is included in the study and it is divided into measurable objective categories of safety and communication, assessment and critical thinking, diagnosis and critical thinking, interventions, evaluation and critical thinking and reflection and critical thinking. An experienced faculty member unfamiliar with the students completes the evaluation, thus controlling research bias. Chi-square tests compare scores between both groups in each category.

The intervention group achieves significantly higher scores in patient safety and basic assessment skills. No differences in performance are found in the other clinical parameters. However, the sample size is too small to provide effect power. The only subcategories of patient safety showing higher scores are in patient identification. The scores in hand hygiene and detecting medical error are comparable between groups. Initial assessment scores are identical but the intervention group has higher scores in vital sign assessment.

This study does not prove the hypothesis in each of the clinical practice parameters. It is unclear why the intervention group does not have improved scores for all clinical practice parameters. The small sample contributes to performance bias and ultimately affects the test results. In addition the intervention group has only 2 hours of additional practice in a 320 hour clinical practice course. This study appears to be the first to test nursing students' performance with a two-patient HPS for 6 clinical practice parameters. Ironside et al. (2009) examined students' patient safety competencies with a 2-patient HPS. The researchers identify that developing HPS scenarios and incorporating them into a nursing curriculum is labour intensive. They also suggest that nursing educators must continue to evaluate HPS scenarios and teaching methods to align with course objectives that relate to patient safety.

Synthesis of the Research and Identification of Themes

In this section I will identify the major themes present in the research articles and compare them to themes present in the literature not meeting the requirements for an integrative review. The eleven articles are based mostly on quantitative research, but a few include mixed and qualitative methods. The themes present in the articles refer to limitations related to sample size, clinical skill development, experiential learning, clinical thinking and reasoning skills,

patient safety, and theoretical frameworks guiding nursing ontology and curriculum development related to HPS.

Sample size or limitations?

The major limitation of the studies is the small sample size. Alinier et al. (2006), Lasater (2007), Radharkrishnan et al. (2007), Ravert (2008) and Sinclair et al. (2009) rely on volunteer participants; as a result there is only an average participation rate of 32% with a mean sample size of 37 for the studies. It is doubtful whether this sample size is sufficient to produce reliability in the quantitative studies. Sample size is not as important in both qualitative studies, Lasater (2007) and Limoges (2010). Polit and Beck (2008) state there are no rules for sample size in qualitative research but test reliability is more a function of the quality of informants and the sampling strategy used (p. 357). Polit and Beck (2008) also state that sample size is more important in quantitative research and as sample size increases so does power. Power refers to the probability of detecting the true relationship between variables. Only Alinier et al. (2006) calculate the power needed to show statistical significance and the researchers determine the sample size of $n=99$ is adequate to achieve the research objectives.

Clinical Skill Development

Four studies examine the relationship between clinical skill development and HPS. The findings in Alinier et al. (2006) support the study's hypothesis and show that clinical skills and competence improve in the experimental group when exposed to HPS. However, the OSCEs and the simulation were not part of the curriculum and could be viewed as extra practice of clinical skills. I agree with Schiavenato (2008) that test scores could be a result of extra practice and not solely a result of HPS exposure. Blum et al. (2010), while using a similar sample, are unable to prove their hypothesis and instead find student skill development and competence increase

regardless of the intervention. This is an interesting finding considering the simulation group has more than twice the students as the control group. The control group is tested using task trainers and volunteer students, and the simulation group uses high-fidelity mannequins. The authors suggest that the use of expensive simulators on entry level nurses is pointless and HPS should be used later in the nursing curriculum.

In a non-experimental pilot project, Kardong-Edgren et al. (2008) design three simulation scenarios guided by the Jeffries Simulation Model (2007), compare students' perceptions of the experience using NLN designed tools and describe faculty perceptions of the implementation process (p.2). Nursing faculty includes foundational clinical skills that historically have been difficult for students to learn into the scenarios. The result is that for the first time in recent history all students pass the exam at the end of the semester; there is no information provided to show the historical pass/fail rate for this exam. This finding I feel validates the value of incorporating HPS into the curriculum. Students rate educational practices, simulation design and self-efficacy highly and validate the research that went into developing the Jeffries Simulation Model (2007). Themes identified by faculty include the experiential learning of the HPS, the observation that repetitive practice solidifies technical and interpersonal skills, HPS supports cognitive reasoning and critical thinking and that faculty requires additional time and knowledge to implement it.

Radharkrishnan et al. (2007) identify clinical practice parameters (safety, assessment skills, prioritization, problem-focused assessment, ensuing interventions) influenced by HPS and measure their improvement. Faculty rate student performance with HPS as high? for patient identification and assessment skills, otherwise the intervention group performs at the same level as the control group. A sample size of $n=12$ in this pilot study is identified by researchers as the

reason for the conflicting results. Another reason may be due to the sample demographic of undergraduate nursing students enrolled in their senior clinical capstone course and the length of the intervention of 2–one hour HPS sessions over the course of the semester. All 6 intervention participants are evaluated in the lead nurse role and prioritize the case of 2 patients that match the characteristics of those in the clinical setting. That the intervention group scored higher in patient identification indicates this skill is not reinforced in the clinical setting. I agree with the authors' belief that educators must systematically evaluate new teaching efforts to document the effectiveness of expensive technology.

Active versus Passive Learning

Arundell and Cioffi (2009) contend that current nursing curricula are comprised primarily of didactic lectures and clinical placements intended to reinforce theoretical knowledge. They maintain students are passive recipients of knowledge and “this style of teaching does not foster their decision-making skills” (p. 296). There is an emphasis on active learning strategies in nursing education because it fosters critical thinking and problem-based learning that is an important part of clinical nursing practice (Young & Paterson, 2007). Simulation allows students to take an active part in their learning and demonstrate to themselves and their instructor their reasoning and problem solving abilities. Reilly Oermann (1990) suggests that students will lose interest in the educational experience without active involvement (cited in Jeffries, 2007, p. 25).

Alinier et al. (2006) describe active learning pedagogies occurring in HPS when they observe students demonstrate communication, teamwork, situation awareness, decision-making and clinical skills (p. 363). Howard et al. (2010) suggest that active learning is the reason the intervention group exposed to HPS scores better than the group exposed to ICS. In fact the scores for the ICS group *decreased* from the pretest score and suggest that ICS is a passive

activity and students experience more fatigue at the end of a session when compared to the HPS group. Kardong-Edgren et al. (2008) state that faculty view simulation as a creative, interactive environment conducive to effective teaching and learning (p. 10). Kuiper et al. (2008) uses situated cognition as the overarching theoretical framework to guide the research design. Situated cognition is rooted in the constructivist theory of learning and suggests that teachers design scenarios and pedagogy so students learn through doing and social interactions, and students' actions lead to the desired outcomes. The Jeffries Model (2007) that guides the simulation design in Ironside et al. (2009) identifies active learning as an educational practices component. Students organize, prioritize care, collaborate, effectively use resources and manage complex and competing demands in caring for multiple human patient simulators. Lasater (2007) identifies that experiential learning found in HPS allows students to see the consequences of their actions. The interactive nature of simulation motivates students and promotes better learning (p. 270).

Critical Thinking and Reasoning

Four studies (Howard et al. 2010, Kuiper et al. 2008, Lasater 2007, and Ravert 2008) evaluate critical thinking with HPS. Howard et al. (2010) compares student knowledge and critical thinking in BSN, accelerated BSN and diploma students when exposed to either HPS or ICS. One of their concerns is that although HPS is an innovative teaching strategy, its expense may not be justified when compared with other less expensive teaching strategies. However they find that greater learning outcomes are achieved by all participants using HPS and this fact outweighs the expensive technology. Also, students prefer HPS and report it assists them in understanding concepts, provides a valuable learning experience and stimulates critical thinking.

The researchers state that administrators must expect to allocate funds to train staff and allow faculty time to write and fine-tune scenarios.

Kuiper et al. (2008) seeks to identify the clinical reasoning activities associated with HPS and determine how they compare with authentic clinical experiences. The researchers make the connection between experiential learning and the projected outcomes of skill competence, confidence and self-efficacy in practice. The situated learning of the simulated experience allows students to apply theory to practice. The researchers suggest that HPS will not replace authentic clinical experience, but it allows students to experience a variety of clinical problems and develop the critical reasoning skills that they will use in the clinical setting. This sentiment is supported by Lasater (2007) and Feingold et al. (2004) who also state that the realistic nature of HPS allows students to see the consequences of their actions. Kuiper et al. (2008) suggest that research should examine how learning in HPS is transferred to the clinical setting; one strategy would be to compare student learning one year post HPS exposure with students who have no exposure.

Lasater (2007) examines nursing students' perspective on the development of clinical judgment with exposure to HPS. Students identify that HPS is effective in their learning and provides them with more challenging scenarios than they are exposed to in the clinical experience. Students value vicarious learning and contrast this with development of self-efficacy as a result of thinking for themselves. Ravert (2008) compares critical thinking disposition, critical thinking skill and preferred learning style between HPS, ICS and regular course content. The researchers are unable to identify a difference in critical thinking based on the intervention or learning style and state that critical thinking is difficult to measure. Participation bias is evident in the small sample size of $n=40$. I would suggest that student perception of clinical

judgment development with HPS in Lasater (2007) is not supported by the findings of Ravert (2008). However students prefer the interactive and experiential nature of HPS and theoretically would be more engaged in learning. Student satisfaction with learning and increased self-efficacy related to HPS is supported by Blum et al. (2010), Kardong-Edgren (2008), and Sinclair and Ferguson (2009).

Patient Safety

Simulation is supported in nurse educator literature as a way to enable students to feel more confident in performing clinical work (Leigh, 2008). Students gain self-efficacy in their practice and develop clinical reasoning and psychomotor skills in a safe environment. The Institute of Medicine's 1999 report "To Err is Human: Building a Safer Health System and the Quality and Safety Education for Nursing (2003) project advocate for improvements to healthcare education that integrate quality and safety content into nursing programs (Alinier, 2006; Ironside et al., 2009). Ironside et al. (2009) states that a national survey of 195 nursing program leaders indicates that quality and safety content is integrated into the nursing curriculum however faculty are unable to identify the pedagogical strategies used to teach them; this fact highlights the need for nursing education reform (p. 333). Simulation addresses this issue by providing students with opportunities to learn and practice skills in a controlled environment that mirrors the complex nature of the workplace without causing harm to patients. Scenarios can be developed that test specific aspects of clinical practice to evaluate nursing specific competencies.

Although the emphasis in nursing education is typically on the individual students' knowledge and skills, team work and effective communication are needed to avert harm to patients. This is especially important when working with other professionals in crisis situations. Simulation is one tool that can be used by a variety of health professionals to improve

communication and team work (Alinier et al. 2006; McGraw, personal communication, July 2010).

Theoretical Frameworks

HPS supports active learning pedagogies such as experiential learning. Ravert (2008) uses Kolb's (1984) Learning Style Inventory to identify students' preferred learning style. Kolb (1984) believes that learning is a process where knowledge is created through the transformation of experience. The researcher is unable to prove the hypothesis that a students' preferred learning style affects learning with HPS. Experiential learning, while not specifically identified as the theoretical framework in studies, is referred to in the literature (Alinier et al., 2006; Kardong-Edgren, 2008; Ironside et al. (2009); Lasater, 2007).

Blum et al. (2010) identifies Tanner's (2006) Clinical Judgment Model as the theoretical framework guiding the study. Tanner (2006) believes that experienced nurses draw on self-confidence, critical thinking and clinical competency when adapting to clinical situations (p. 1). The model identifies the importance of noticing, interpreting, responding and reflecting on the development of clinical judgment. The researchers use an evaluation tool grounded in Tanner's (2006) model to evaluate the transfer of nursing knowledge, skill development and confidence from the simulation lab to the clinical setting (p. 1).

Situated Cognition is a theory of instruction that suggests learning is naturally tied to authentic activity, context and culture (Brown, Collins & Duguid, 1989). Learning evolves from the interaction of people, activity and prior knowledge. Situated Cognition is a nursing pedagogy used in simulation scenarios to direct student learning for best reinforcement of clinical reasoning outcomes (Kuiper et al., 2008; Woolley & Jarvis, 2006). Sinclair and Ferguson (2009) identify Bandura's (1977, 1986) theory of self-efficacy as an important foundation explaining

how knowledge is integrated. An individual's belief in his or her ability to achieve plays a role in how he or she would approach goals, tasks and challenges.

Kardong-Edgren uses the Rogers (2003) Diffusion of Innovation theory to guide the integration of simulation into their nursing curriculum. It is a theory of how, why and at what rate technology and new ideas flow through an organization. Specifically adoption of new ideas follows a predictable pattern and flows through communication networks. In addition to a theory guiding a change in nursing pedagogy, the researchers use the Jeffries Simulation Model (2007) to guide the simulation design. The framework links five concepts; educational practices, the teacher, the student, simulation design characteristics and outcomes. This model also guides research by Ironside et al. (2009). This framework is the result of research funded by the NLN in partnership with the Laerdal Corporation that designs the interactive mannequin. While the framework is intended to be used with all types of simulations (high or low fidelity) there may be some conflict of interest from the association with industry. I believe that the Jeffries Model is the best framework currently available to guide the complex, multifaceted and challenging nature of HPS. Limoges (2010) uses the institutional ethnography and critical feminist theory of Dorothy Smith (1987, 1990, 2005, and 2006) to guide this study. The researcher explores the ruling discourses of biomedicine, relational ontology and efficiency that organize knowledge development in HPS.

Recommendations

Simulation use in undergraduate nursing education is being driven by changes in health care delivery, the need to improve patient safety, a focus on ethical nursing care that considers the rights of patients and a shift to outcomes-based education that allows for assessment and demonstration of competence. The CRNBC recognizes that providing practice learning

experiences is challenging, especially in acute care settings and student learning can be augmented and maximized with a variety of learning opportunities that include simulated patients (College of Registered Nurses of B.C. [CRNBC], 2009). While HPS does not replace direct client nursing care, it gives students the ability to develop cognitive, psychomotor and psychological skills in a safe environment and augments clinical experience.

Theoretical Frameworks Guiding Nursing Pedagogies

Educators need to develop teaching strategies with HPS that are guided by theoretical and empirical frameworks and develop best practices for its use (Bremner, Aduddell, Bennett and VanGeest, 2006; Cant and Cooper, 2010; Jeffries, 2005). HPS supports active learning pedagogies such as experiential learning. Kolb (1984) is one theoretical framework that educators can use to guide nursing pedagogy (Alinier et al. 2006; Howard et al. 2010). Kolb (1984) believes that learning occurs when knowledge is transformed through experience (p. 38). Clapper (2010) describes Knowles Theory of Adult Learning and suggests that adults learn differently than pre-adults. Concepts such as self-directedness, experience as resource for learning, internal motivation to learn and the need to know why something should be learned are examples of this theory (p.8). It is important that educators tailor the educational philosophy to the needs of the learner (Jeffries, 2007; Parker & Myrick, 2009). In addition Kardong-Edgren et al. (2008) suggests that when students are actively engaged in HPS, the diverse needs of learner types (tactile, kinesthetic, auditory and visual) are met. Today's students can be demographically and culturally diverse; therefore from a learner centered teaching philosophy, it is important that students' learning needs are met.

Clapper (2010) also highlights MacLean's Triune Brain theory to reinforce that emotions are a powerful tool for learning. This theory explains why "higher-order learning might not occur

when the environment is not positive to learning” (p.11). HPS provides an environment whereby students can learn in a realistic, but safe environment. Students can make mistakes and learn to recognize and correct them in the forgiving environment of the simulation, without fear of punishment or harm to real patients. At the same time, the educational experience becomes truly learner-centered, instead of focused on the patient, as is appropriate in actual clinical settings.

Sportsman et al. 2009; Blank, Camp & Hinton, 2009; Childs & Sepples, 2006 identify Benner’s novice to expert theory as supporting clinical skill development. Miller (1990) develops a Framework for Clinical Assessment explaining that students must have competence (know how), performance (show how) and action (actually do), [as cited in McCallum, 2007)]. This is an example of how students link theory to practice (p. 828). Educators can use this theory to guide evaluation of students in HPS.

Situated Cognition is a theory of instruction that suggests learning is naturally tied to authentic activity, context and culture (Brown, Collins & Duguid,1989). Learning evolves from the interaction of people, activity and prior knowledge. Paige and Daley (2009) argue that this teaching pedagogy is useful in HPS because of the level of complexity afforded in the realistic scenarios. Situated Cognition as a nursing pedagogy is used in simulation scenarios to direct student learning for best reinforcement of clinical reasoning outcomes (Kuiper et al., 2008; Woolley & Jarvis, 2006).

Sinclair and Ferguson (2009) identify Bandera’s (1977, 1986) theory of self-efficacy as an important foundation explaining how knowledge is integrated. An individual’s belief in his or her ability to achieve plays a role in how he or she would approach goals, tasks and challenges. Tanner’s (2006) Clinical Judgment Model is based on the theory that skilled nurses adapt to clinical situations by drawing on their self-confidence along with critical thinking and clinical

competency. The model emphasizes that clinical judgment develops as the result of the integration of noticing, interpreting, responding and reflecting. While faculty have historically assessed student self confidence by observation, this is subjective and does not capture students' perception of their self-confidence (Blum et al. 2010). Lasater and Nielsen (2009) suggest that self-reflection, in addition to clinical skill practice, support increased student self-confidence in nursing assessment and skill development (cited in Blum et al. 2010, p. 2).

A review of the literature indicates that users of simulation technology are critically evaluating teaching and learning theory with the practices of conducting and evaluating simulation (Clapper, 2010; Jeffries, 2007; Kardong-Edgren, Kaakinen and Arwood, 2009; Paige and Daley, 2009). Kaakinen and Arwood (2009) suggest that faculty involved in the development of simulations should focus on the purpose of the simulation, specifically if the focus of the simulation is on teaching or learning. In their analysis of nursing simulation literature between 2000 and 2007, they conclude that most nursing faculty approach simulation from a teaching paradigm rather than a learning one (abstract). This is an interesting observation and contrasts with Jeffries (2007) who posits that "the use of simulation in education has most often been grounded in theories that focus on learner-centered practices, constructivism and collaboration between individuals with different sociocultural backgrounds" (p. 23).

HPS differs from traditional didactic classrooms that are teacher-centered by being student-centered, with the teacher playing the role of facilitator and evaluator. I observe that lab sessions at The University of the Fraser Valley (UFV) consist of didactic content, however there are problem solving and constructivist activities included to facilitate active learning. Content important to the foundations of knowledge for first year nursing students is reinforced, and the expectation is that students will prepare for the class by doing the assigned readings. In addition

to theoretical frameworks guiding simulation design, there are other considerations that make incorporating simulation into an existing curriculum a challenging task.

Theoretical Frameworks Guiding a Change in Nursing Ontology

With the advent of HPS, there has been increasing pressure on learning institutions and educators to adapt to different pedagogies and ways of teaching. Prensky (2001) coined the terms *digital immigrant* and *digital native* to describe the difference between faculty who have to adapt to technology and students who have grown up in the digital age (as cited in Kardong-Edgren, Starkweather and Ward, 2010). Starkweather and Kardong-Edgren (2008) discuss reluctance by the nursing program to integrate HPS into the nursing curriculum. Hodge et al. (2008) devise a simulation plan as a result of having unused expensive high-fidelity technology sit idle for 2 years. This resistance to adapting to new technology is addressed when institutions look at theories of change. Identified barriers to a change in nursing ontology include fear of the unknown by faculty who are perfectionists, lack of time and support and adapting philosophies of teaching to new technology.

Kardong-Edgren, Starkweather and Ward (2010) use the Diffusion of Innovation theory (Rogers, 2003) to aid in moving simulation adoption forward in a nursing curriculum. It is a theory of how, why, and at what rate technology and new ideas flow through an organization. Specifically adoption of new ideas follows a predictable pattern and flows through communication networks. Starkweather and Kardong-Edgren identify five stages through which new ideas pass: knowledge, persuasion, decision, implementation and confirmation (p. 2). Adoption personalities range from innovators and early adopters to laggards. An individual may reject an innovation at any time during or after the adoption process. Strategies used focus on creating interest and providing education for faculty. Identifying a “champion” among the

faculty, developing workshops and using fundamental clinical skills at the beginning stages of the curriculum provide the building blocks to grow their program. Leigh and Hurst (2008) also mention using a “champion” as a change agent.

Educators new to this type of teaching will require support with learning the technology, designing the scenarios, and feeling comfortable with the simulations they are using.

Administrators must expect to spend money to train staff, allow faculty time to write scenarios and rework them as necessary (Howard et al., 2010). The use of faculty development workshops and pilot testing HPS scenarios reduces educator anxiety and allows for fine-tuning of the simulations. I observed the practice of faculty coming in on their day off to assist other faculty with simulations. Initially it is overwhelming to take responsibility for all aspects of a simulation in the early stages of implementation of the scenario into the curriculum and provide quality, focused feedback to students (observation at Douglas College, February, 2010). This sentiment is supported by findings in Kardong-Edgren et al. (2008). The B.C. Lab Educators have formed a grass roots simulation interest group that is a good resource for faculty. At their May, 2010 conference, Dr. Pamela Jeffries appeared as one of the guest speakers and attendants came from as far away as Alberta.

Hodge et al. develop a curriculum map through discussions with faculty. Nursing faculty agree to include no more than 10% of clinical hours in simulation. In addition it would be used primarily as a teaching strategy until faculty became more comfortable using it; at that time it would be used for testing clinical competence. Other institutions have initially introduced simulation into first semester clinical foundations and assessment courses (UFV, Florida Atlantic University, Washington State University). I agree that it should be easier to integrate HPS into first year clinical foundations courses and with scaffolding; scenarios could be made more

complex in relation to more intricate concepts. I agree that this strategy would meet the needs of faculty learning new ways of teaching and facilitating learning. Tanner (2006) observes that educational practices must prepare nurses to engage with patients and that clinical reasoning should always be in relation to the particular patient and situation. However, research by Blum et al. (2006) indicates the necessity for further reconsideration of the use of expensive simulation equipment with pre-licensure students building foundational skills. They suggest that the appropriate place for HPS remains in later semesters as advanced students are better able to integrate multiple contextual factors and process complex situations.

Components of an Ideal Simulation Framework Design

Based on this review of literature related to HPS and observations of a variety of simulation labs, to achieve the ideal simulation design I recommend:-

1. Learning be actively constructed in learner centered pedagogies where the educator is a facilitator of learning and the simulation experience is tailored to the diverse needs and learning styles of the learner, e.g. tactile, kinesthetic, auditory, visual (Jeffries, 2005; Kardong-Edgren et al., 2008 Parker & Myrick, 2009).
2. There be a conceptual framework is based on theoretical and empirical literature specifying relevant variables and their relationship; this is important to develop research in an organized, systemic fashion (Cioffi, 2001; Jeffries, 2005, 2007; Kardong-Edgren, Adamson and Fitzgerald ,2010)
3. Simulation framework should be flexible and adaptable to the needs of institution, curriculum design and level of fidelity (Hodge et al., 2008; Jeffries, 2005, 2007)

4. Based on best practices in education that support active learning, student-faculty interactions, collaborative learning, effective student feedback, diverse learning styles, efficient time on task and set high expectations (Jeffries, 2005, 2007)
5. Students are self directed and motivated and active participants in the simulation (Cioffi, 2001)
6. Clearly written objectives are needed when simulations are used to guide students' learning and outcome achievements. These would include patient history, information about the activity, the simulation process, amount of time required, role expectations and outcome expectancies (Jeffries, 2005)
7. Fidelity matches the learning goals, e.g. low fidelity injection pads to support learning how to give an injection to high fidelity mannequins to simulate a patient with pneumonia
8. Simulations increase in complexity in relation to the course learning goals and experience and knowledge of the student (Hodge et al., 2008)
9. Cues are provided to help the student progress through the activity; there should be little information provided initially, the student should be allowed to problem solve and the student should be given the clinical information over time during the simulation (Cioffi, 2001)
10. Debriefing to encourage reflective learning (Jeffries, 2005, 2007)
11. Outcomes related to nursing knowledge, skill performance, learner satisfaction, critical thinking and self-efficacy (Jeffries, 2005)

HPS allows students to be active learners who are expected to take responsibility for their learning. Therefore, student learning is dynamic and occurs in situations that mimic actual clinical encounters; students may deal with ambiguous and missing information, prioritize and

plan care for their patient and initiate interventions that have an immediate effect on their patient. Students may assume a variety of roles (lead nurse, assistant nurse, family member or physician) and learn vicariously through the actions of other students. HPS allows students to take an active part in their learning and demonstrate to themselves and their instructor their reasoning and problem solving abilities. Students are encouraged to verbalize their clinical reasoning to help the educator provide appropriate feedback.

Diverse learning types (tactile, kinesthetic, auditory and visual) are supported with HPS. Learning in HPS is process-based; for example the simulated patient informs the student that he feels the urge to urinate but is unable to void. The student assumes the Registered Nurse role and through the clinical reasoning process, initiates the appropriate intervention. In contrast, in the clinical environment, student learning is response based and the student provides nursing care under the direction of the preceptor.

Educational practices that support active learning, prompt feedback, student/faculty interactions, collaborative learning, high expectations, diverse learning styles and time on task, are associated variables identified in this framework. Students are involved in activities that require active participation. Prompt feedback is supported in the literature as being very important (Ironside et al. 2010). Collaborative learning is evident when students observe other approaches to clinical problems. Jeffries (2005) contends that when both students and faculty have high expectations for the simulation process, positive outcomes are achieved (p. 100). When students are prepared, scenarios run effectively and students can be briefed regarding how a simulation functions and their responsibilities. Students also receive a report on the patient prior to the start of the scenario and understand their role. I observe inconsistencies in the length of time spent in simulation in the literature and from observations at the BC Lab Educators

Conference; simulation times varied upwards from 2 hours to a full day. Jeffries (2005, 2007) recommends a 10 minute briefing followed by a twenty minute scenario and twenty minute debriefing. I agree with her recommendations. One limitation of HPS, however, there is the limited number of students that can participate at one time.

Simulation design should be as realistic as possible. Current simulation suites mimic single or multipatient hospital rooms and usually include equipment that students are familiar with, for example IV pumps, medications. The intent is to prepare students for the complex, clinical environment. To increase the reality of the environment educators can play recorded hospital sounds on a DVD player or use “moulage” to develop bruising or provide a fruity breath in their patient.

Recommendations for Further Research

Canadian data from a 2008 Patient Simulation Needs Assessment show that only 16% of educators and 17% of nurses have three or more years of experience with HPS (CPSI, 2008). This indicates that simulation use in nursing education is in its beginning stages. Research related themes found in the literature include the need for theoretical frameworks to guide nursing pedagogies, the need for consistent evaluation instruments, the need to evaluate how learning in simulation is transferred to the clinical setting, and the need for research into the appropriate use of the technology (in nursing curriculum, in hospital based competency training,). The costs associated with setting up a simulation suite are significant and Hodge et al. (2008) argue that without a structured plan for when, why and how simulation will be used, HPS is no more than an expensive and rarely used adjunct to traditional teaching and learning practices.

Research into how knowledge acquired in HPS is transferred to the clinical setting could be accomplished by comparing graduate nurse performance with and without simulation over the course of the first year. More research is warranted on the predictive validity of HPS for example, on whether performance on a given assessment can predict future performance in the clinical setting. Harder et al. (2009) advocate for continued research on teaching and learning practices to take advantage of simulation experiences. Cant and Cooper (2010), Kardong-Edgren, Starkweather and Ward (2008), and Schiavenato (2008) argue for more research into developing a universal evaluation instrument. I agree with their suggestions; there must be evidence that learning or mastery of skills occurs to ensure that competencies required of graduate nurses are met. Educators must systematically evaluate new teaching efforts to document the effectiveness and utilization of expensive technology.

There is a paucity of quantitative evidence supporting HPS as superior to other teaching modalities. In research by Kardong-Edgren et al. (2008) students rate satisfaction and self-confidence with the educational practices and simulation design highly while faculty has mixed reactions. Despite this fact, the majority of faculty agrees that HPS is a valuable tool and should be incorporated into the curriculum. It must be added that for the first time in recent history all students in this study passed the course paper and pencil exam. There is a need for more effective research that includes a sample large enough to prove/disprove the hypothesis. Conducting multi-site research with a large convenience sample would be advantageous. Perhaps this will occur as the current simulation programs mature.

Kuiper et al. (2008) indicate there is a great deal of knowledge to be gained in understanding the role that debriefing plays in learning. They also suggest that future testing of models and theories is needed in the area of simulation based learning and more research is

needed in incorporating simulation activities into student evaluation and curriculum development. They question how learning is transferred into the clinical setting and propose that research go into comparing graduate nurses one year post HPS with a non HPS group of nurses.

Research is needed to document the effectiveness of nursing curricula to prepare practice-ready students and to investigate student factors that may influence student achievement in simulation experiences (Ironside et al. (2009). These researchers also advocate further study of how HPS can support the development of student achievement in the entire range of safety competencies. Improving healthcare education by integrating quality and safety content into nursing programs has been identified as paramount in a number of reports; Alinier et al. 2006; CSPI, 2008; Ironside et al., 2009. Research is needed to identify and incorporate pedagogical strategies used to integrate quality and safety content into nursing curricula through the use of HPS (Ironside et al., 2009). HPS could be used to enhance the development and evaluation of team collaboration and the building of a safety-oriented culture. Effective communication is important to prevent patient errors.

Conclusion

The use of simulation in nursing education is being driven by the reduction in consistent practica experiences and the need to develop higher levels of critical thinking to prepare professional nurses for the complex healthcare environment. HPS has reached the level of realism that mimics clinical situations and provides a safe environment to practice the skill development and clinical reasoning important for the complex and real world of nursing. There is an expectation from institutions that new graduates possess the critical thinking and clinical skills to quickly become fully functioning members of the nursing staff. There is pressure on educators to prepare nurses to provide ethical, evidence based care while having the ability to

work in a multidisciplinary and collaborative nursing practice. Patient acuity continues to increase in acute care, along with fast turnover of patients. From a patient safety perspective, HPS allows students to try different approaches to patient care along with perfecting skills, without harming the patient. HPS is being embraced for use in college, university, government agency and hospital settings to educate medical, nursing and allied staff such as paramedics. However, simply purchasing the equipment without the appropriate leadership to guide how it is integrated into nursing education is shortsighted.

With the increased use of simulation equipment in nursing programs, it is crucial that in its design, a theoretical framework guides implementation and evaluation, and best practice guidelines are developed. It is incumbent on administrators to allocate funds on a stable basis to provide a supply of adequately trained staff, to design and incorporate simulation into existing nursing curricula and to identify and evaluate programs. Nursing educators must continue to evaluate simulation programs and teaching methods to align with course objectives that relate to patient safety. In addition, educators must systematically evaluate new teaching efforts to document the effectiveness of expensive technology. It is important to ensure that simulation is applied to nursing education in a comprehensive, rather than piecemeal approach.

HPS is well received by students due to its clinical realism and ability to support experiential learning. Students report that HPS provides them with more challenging scenarios than they are exposed to in the clinical experience, and prompts them to think on the spot and solve problems independently. This develops clinical reasoning skills they will use in clinical practice. It is important that educators understand different learning styles and develop student-centered pedagogies to cultivate learning in all learners.

There is a steep learning curve associated with the use of HPS in nursing education and faculty need adequate time to learn the technology; develop scenarios that are linked to theoretical, course objectives; and be prepared to direct learning in both the HPS scenarios and the debriefing session. This may require hiring additional staff such as lab assistants and educators to develop curriculum. There is a trend to interprofessional education and simulation is a vehicle for supporting this. There is a collaborative model used by Queens University whereby medicine and nursing share expenses and use of the simulation lab space. Skills such as ACLS training incorporate multiprofessional teams in the course. A large percentage of adverse events are a result of poor communication; simulation enhances the development and evaluation of effective collaborative teams of interprofessional and the building of a safety-oriented culture.

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Appendix A

Table A1.

Citation: Authors: _____
 Title: _____
 Journal: _____
 Year: _____ Volume: _____ Issue: _____ Pages: _____
 Type of study: Qualitative Quantitative Mixed
 Location: _____
 Key Concept: _____
 Variables: Interventional/Independent Variable: _____
 Dependant Variable: _____
 Controlled Variable: _____
 Framework/Theory: _____

 Design Type: Experimental Nonexperimental Quasi-experimental
 Specific Design: _____
 Blinding: None Single Double
 Description of Intervention: _____

 Comparison Group: _____
 Cross Sectional Longitudinal/Prospective No o Data Points: _____
 Qualitative Tradition: Grounded Theory Phenomenology Ethnography Other
 Sample: Size: _____ Method: _____
 Characteristics: _____
 Data Sources: Self Report Observational Biophysiologic Interview Other
 Description of Measures: _____
 Quality: _____
 Statistical Tests: Bivariate T-Test ANOVA Chi-Square Pearson's R Multi Var
 Multiple Regression: MANOVA Logistic Regression Other
 Findings: _____

 Effect Sizes: _____
 Themes: _____

 Recommendations: _____

 Strengths: _____

 Weaknessess/Limitations: _____

Adapted from Polit & Beck, 2008, p. 120.

Appendix B

Table B1. *Excluded Articles*

CITATION	PURPOSE	EXCLUSION CRITERIA
Bearnson, C. S. & Wiker, K. M. (2005). Human patient simulators: A new face in baccalaureate nursing education at brigham young university. <i>The Journal of Nursing Education</i> , 44(9), 421-425.	To determine the benefits and limitations of using HPS as a patient substitute for one day of clinical exp.	Not a rigorous research study, does not fully describe sample size, methodology etc.
Blank, J., Camp, S. & Hinton, H. (2009). It's not just skills anymore! Teaching with medium fidelity technology. <i>Clinical Simulation in Nursing</i> , 5(3), Supplement 1, p.132.	Teaching strategies for using medium fidelity manikins to their full potential.	Poster abstract
Cant, R.P. & Cooper, S.J. (2010). Simulation-based learning in nurse education: systematic review. <i>Journal of Advanced Nursing</i> , 66(1), 3–15.	To determine if using medium to high fidelity manikins in simulation based learning is an effective teaching strategy.	Systemic review
Childs, J. C. & Sepples, S. (2006). Clinical teaching by simulation: Lessons learned from a complex patient care scenario. <i>Nursing Education Perspectives</i> , 27(3), 154-158.	As part of the NLN and Laerdal study, to examine the simulation development and implementation process and measure student satisfaction as an outcome	Part of a larger study; less emphasis is placed on research methodology, statistics etc. in the paper
Cioffi, J. (2001). Clinical simulations: Development and validation. <i>Nurse Education Today</i> , 21(6), 477-486.	What is the conceptual and applied approach to simulation development and validation in clinical obstetric practice?	Concerned with case based simulation; pre 2005
Clapper, T. C. (2010). Beyond Knowles: What those conducting simulation need to know about adult learning theory. <i>Clinical Simulation in Nursing</i> , 6(1), 7-14.	What learning theories, other than Knowles, might affect the way adult learners reach understanding of clinical expertise, meet clinical and organizational objectives and seek out learning opportunities	Lit review
Harder, N. B. (2009). Evolution of simulation use in health care education. <i>Clinical Simulation in Nursing</i> , 5, p. 25-35. doi:10.1016/j.ecns.2009.04.092.	What is the evolution of simulation in nursing education in the context of technology, accessibility and teaching pedagogy?	Lit. review
Hodge, M. E., Martin, C., Tavernier, D., Perea-Ryan, M. & Alcalá-Van Houten, L (2008). Integrating simulation across the curriculum. <i>Nurse Educator</i> , 33(5), 210-214.	Historical description of integrating simulation in the nursing curriculum of a small baccalaureate nursing program	Lit. review

National League of Nursing. (2006). Designing and Implementing Models for the Innovative Use of Simulation to Teach Nursing Care of III Adults and Children: A National, Multi-Site, Multi-Method Study, 1-17. Retrieved from http://www.nln.org/research/laerdalreport.pdf	To develop and test models that nursing faculty can use when using simulation to promote student learning.	Research report only; does not describe the methodology
Jeffries, P. R. (2005). A framework for designing, implementing, and evaluating: Simulations used as teaching strategies in nursing. <i>Nursing Education Perspectives</i> , 26(2), 96-103.	What teaching and learning practices with simulation contribute to positive outcomes? What is the role of the teacher? How does simulation design contribute to the overall teaching and learning experience?	Not a rigorous research study; does not describe methodology
Kardong-Edgren, S., Adamson, K. A. & Fitzgerald, C. (2010). A review of currently published evaluation instruments for human patient simulation. <i>Clinical Simulation in Nursing</i> , 6(1), p.25-35.	What evaluation instruments are currently being used to assess learning in patient simulation	Systemic review
Lasater, K. (2006). Clinical judgment development: Using simulation to create an assessment rubric. <i>Journal of Nursing Education</i> (2007), 46(11), 496-502.	Can clinical judgment in HPS be assessed with a rubric?	Concept of clinical judgment is addressed by the author in a subsequent article; some repetitious themes
Leigh, G. T. (2008) High-fidelity patient simulation and nursing students' self-efficacy: A review of the literature, <i>International Journal of Nursing Education Scholarship</i> , 5(1), 37, 1-17.	How to maximize the use of simulators, dispel reservations of faculty, and provide hints on how to build successful scenarios and how to encourage their use in an undergraduate nursing faculty	Historical account, not pure research
McCallum, J. (2007). The debate in favour of using simulation education in pre-registration adult nursing. <i>Nurse Education Today</i> , 27(8), 825-831.	What are the advantages and disadvantages of using simulation education as a teaching, learning and assessment methodology within pre-registration nurse education?	Lit review
Moule, P., Wilford, A., Sales, R. & Lockyer, L. (2008). Student experiences and mentor views of the use of simulation for learning. <i>Nurse Educator Today</i> , 28(7), 790-797.	Student experiences and mentor views of the use of simulation for learning	Does not refer to HPS; refers to case study
Nehring, W. M. & Lashley, F. R. (2004). Current use and opinions regarding human patient simulators in nursing education: An international survey. <i>Nursing Education Perspectives</i> , 25(5), 244-248.	How is HPS used internationally in nursing education?	A survey of HPS use worldwide
Paige, J. B. & Daley, B. J. (2009). Situated cognition: A learning framework to support and guide high-fidelity simulation. <i>Clinical Simulation in Nursing</i> , 5(3), 97-103.	The authors suggest that situated cognition is a more concise learning framework than conventional High-fidelity simulation (HFS).	Lit review
Parker, B. C. & Myrick, F. (2009). A critical	What are the predominant	A critical examination; not a qualitative

examination of high-fidelity human patient simulation within the context of nursing pedagogy. <i>Nurse Education Today</i> , 29(3), 322-329.	educational philosophies of behaviorism and constructivism that guide modern nursing pedagogy and how does each perspective impact on high-fidelity HPS integration into nursing curriculum?	or quantitative research based
Rothgeb, M. K. (2008). Creating a nursing simulation laboratory: A literature review. <i>Journal of Nursing Education</i> , 47(11), 489-494.	A review of all types of simulation used in nursing education	Lit review
Schiavenato, M. (2008). Reevaluating simulation in nursing education: Beyond the human patient simulator. <i>Journal of Nursing Education</i> , 2009, 48(7), 338-394.	To argue for a need for theory to answer the question of why simulation is used in nursing to anchor its proper and effective application in nursing education; less is known about simulation in nursing education than implied by its seemingly universal adoption	Lit review & synthesis
Sportsman, S., Bolton, C., Bradshaw, P., Close, D., Lee, M., Townley, N., Watson, M. N. (2009). A Regional Simulation Center Partnership: Collaboration to Improve Staff and Student Competency. <i>The Journal of Continuing Education in Nursing</i> , 40(2), 67-73.	A partnership between a hospital, university and community college is an excellent framework to provide competency education and validation for nursing students and staff	Historical account ; not research
Starkweather, A. R. and Kardong-Edgren, S. (2008) Diffusion of innovation: Embedding simulation into nursing curricula. <i>International Journal of Nursing Education Scholarship</i> , 5(1), 13, 1-11. DOI: 10.2202/1548-923X.1567	What strategies are required to embed simulation into an undergraduate program when there is faculty resistance?	Historical account
Waldner, M. & Olson, J. (2007). Taking the patient to the classroom: Applying theoretical frameworks to simulation in nursing education. <i>International Journal of Nursing Education Scholarship</i> , 4(1), art. 18, 1-14.	To evaluate using Benner's skill acquisition theory with Kolb's experiential learning theory as the theoretical underpinnings guiding simulation use in nursing education	Lit review & synthesis

Appendix C

Table C1. *Included Articles*

CITATION	PURPOSE	INCLUSION CRITERIA
Alinier, G., Hunt, B., Gordon, G. & Harwood, C. (2006). Effectiveness of intermediate-fidelity simulation training technology in undergraduate nursing education. <i>Journal of Advanced Nursing</i> , 54(3), 359-369.	What is the effect of scenario-based simulation on nursing students' clinical skills and competence?	Deals with intermediate-fidelity; quantitative research; sample size n=99; good description of research instrument, methodology, limitations of study. Has benefit to nursing by exploring the effect of scenario-based simulation on clinical skills and competence
Blum, C., Borglund, S. & Parcells, D. (2010). High-fidelity nursing simulation: Impact on student self-confidence and clinical competence. <i>International Journal of Nursing Education Scholarship</i> , 7(1), Art. 18, 1-14.	What is the relationship between simulation and student self-confidence and clinical comp	Meets inclusion criteria; uses a conceptual model (Tanner's clinical judgment model); N=53; good description of demographic information of sample, current references
Howard, V. M., Ross, C., Mitchell, A. M. & Nelson, G. M. (2010). Human patient simulators and interactive case studies: A comparative analysis of learning outcomes and student perceptions. <i>CIN: Computers, Informatics, Nursing</i> , 28(1), 42-48.	Is the cost of Human Patient Simulators justified comparing learning using Simulation with Case Studies	Matches inclusion criteria; n=49; good description of research instrument, methodology, limitations of study.
Ironsides, P., Jeffries, P. & Martin, A. (2009). Fostering patient safety competencies using multiple-patient simulation experiences. <i>Nursing Outlook</i> , 57(6), 332-337.	Do multiple-patient simulation experiences improve patient safety competencies? What are the relationships between student factors (age, GPA, and tolerance for ambiguity) and achievement of patient safety competencies?	n=413; meets inclusion criteria; multisite study, good description of research instrument, methodology, limitations of study
Kardong-Edgren, S. E.; Starkweather, A. R. & Ward, L. D. (2008). The integration of simulation into a clinical foundation of nursing course: Student and faculty perspectives. <i>International Journal of Nursing Education Scholarship</i> , 5(1), 26, 1-16.	How do faculty and students perceive integration of simulation into a "clinical foundations of nursing course"? To design three simulation scenarios using the Jeffries (2007) framework; compare student perceptions of simulation experiences over time using tools designed by the National League for Nursing (2006); and characterize faculty perceptions of the simulation implementation process.	Medium fidelity; n=100; uses the Jeffries Nursing Education Simulation Framework;
Kuiper, R.A., Heinrich, C., Matthias, A, Graham, M. J. & Bell-Kotwall, L.	What is the impact of patient simulation technology on situated	n=44; theoretical framework described, meets inclusion criteria;

<p>(2008). Debriefing with the OPT model of clinical reasoning during high fidelity patient simulation. <i>International Journal of Nursing Education Scholarship</i>: 5(1), 17, 1-14.</p>	<p>cognition of undergraduate nursing students? What clinical reasoning activities are apparent in patient simulation and how do they compare with authentic clinical experiences? How effective is the OPT model of clinical reasoning when used as a method of debriefing following patient simulation?</p>	<p>good description of research instrument, methodology etc.</p>
<p>Lasater, K. (2005). High-fidelity simulation and the development of clinical judgment: Students' experiences. <i>Journal of Nursing Education</i> (2007), 46(6), 269-276.</p>	<p>How effective is high-fidelity simulation on the development of clinical judgment in nursing students?</p>	<p>n=48; the article focuses on the findings from the prospective of the student experiences and deals with the results of the focus group. Qualitative study. Findings mirror those of Jeffries and form the basis for the Jeffries framework of simulation design.</p>
<p>Limoges, J. (2010). An exploration of ruling relations and how they organize and regulate nursing education in the high-fidelity patient simulation laboratory. <i>Nursing Inquiry</i>, 17(1), 58-64.</p>	<p>A critical, feminist view of the ruling discourses of biomedicine and efficiency and they regulate nursing education in the simulated learning environment</p>	<p>Critical feminist research into discourses organizing teaching/learning in simulation labs. Qualitative research, Canadian study.</p>
<p>Radharkrishnan, K., Roche, J. & Cunningham, H. (2007). Measuring clinical practice parameters with human patient simulation: A pilot study. <i>International Journal of Nursing Education Scholarship</i>, 4(1), Art. 8, 1-11.</p>	<p>To determine the clinical practice parameters influenced by HPS.</p>	<p>Meets criteria, however there was a small sample n=12 and the results were not significant apart from patient identification and basic assessment skills.</p>
<p>Sinclair, B. & Ferguson, K. (2009). Integrating simulated teaching/learning strategies in undergraduate nursing education. <i>International Journal of Nursing Education Scholarship</i>, 6(1), 7, 1-11.</p>	<p>Do students' self-efficacy, satisfaction and effectiveness improve when exposed to both lecture and simulation? To assess student's perceptions of self efficacy for nursing practice when using a combination of lecture and simulation in a nursing theory course compared to students who only used lecture</p>	<p>n=250; quantitative/qualitative study, good description of research instrument, methodology, limitations of study etc. Canadian study which is rare!!!</p>

Footnotes

¹ In literature searches, using citations from relevant studies to track down earlier research upon which the studies are based (Polit & Beck, 2007, p. 747).