

SIMULATION WITH COMPUTERIZED PATIENT MODELS: PERCEPTIONS
OF FACULTY AND ASSOCIATE NURSING STUDENTS

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ABSTRACT

RESEARCH PAPER: Simulation with Computerized Patient Models: Perceptions of Faculty and Associate Nursing Students

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Advanced technology, lack of clinical placement opportunities for students, and need for patient safety have increased usage of computerized patient simulators in schools of nursing. The purpose of this study is to replicate Feingold, Calaluce, and Kallen's 2004 research to evaluate student and faculty perception of simulated clinical scenarios when using computerized patient simulators. Specific areas evaluated are related to reality of simulation, transferability of learning in simulation to actual clinical settings, and the value of clinical simulations. The sample population will be students enrolled in an associate nursing program who will use SimMan as part of their educational preparation and the faculty that provide the experience with clinical simulations. Sixty students and six faculty members will complete satisfaction surveys. This survey was developed by Feingold et al (2004) by drafting a tool described in literature. Students will be surveyed on a 20-item tool with a 4-point Likert scale. Faculty will be surveyed on a 17 item tool with a 4-point Likert scale. Findings will contribute additional data for review concerning the usefulness of computerized patient simulation for realism, transferability, and value.

Chapter I

Introduction

Simulation is a technique designed to immerse learners in situations they will encounter once training is complete. It allows students to process important information and react to that information without endangering themselves or others. According to Hyland & Hawkins (2009), this technique has been broadly used in military and commercial aviation training, since the 1930s. Pilot training used simulation models that were designed and tested to measure increased levels of a pilot's abilities and safety standards while decreasing pilot errors. Medicine adopted simulation techniques from these experts to implement training for emergency medicine, anesthesia, and critical care areas. Hyland and Hawkins (2009) concluded in their review of literature that using simulation as a teaching pedagogy has improved learners' performances and demonstrated interrater reliability.

According to the National Council of State Boards of Nursing (NCSBN) Research Brief (2009), simulation has been a long standing practice in nursing education. Starting in the Hartford Hospital Training School in 1911, a simple life size mannequin was used in nursing training (Hyland & Hawkins, 2009). This mannequin was considered a low fidelity simulator that served more as an aid to learning than as a part of a formalized teaching program. As time progressed, fidelity has increased from low to moderate level fidelity and most recently to very complex or high fidelity simulators. The growth of

technology has enabled faculty to mimic real situations students will encounter once students are in the clinical setting. This technique allows students to experience the psychomotor skills required to accomplish a task and provides an opportunity for building decision-making skills necessary for competent patient care. Currently with the availability of rapidly advancing technology, increased complexity in the health care setting, concerns for patient safety, and lack of clinical placement opportunities, simulation is getting a fresh look.

Growing expectations for nurses to exit school fully prepared for the complex health care setting has been complicated by a number of factors. Availability of clinical spaces is complicated by competition between schools of nursing for clinical opportunities. Specialized areas limit the number of students allowed at one time. Health care agencies place limits on the type of procedures students may perform. Coordination of clinical with classroom content is difficult. This issue of shrinking clinical opportunities combined with high expectations has placed increased pressure on faculty to train novice nurses (Linder & Pulsipher, 2008). Simulation has the potential to help faculty better prepare nurses, especially when faculty understand issues connected with the new nurse entering the workplace. When surveyed, the newly graduated nurse often expresses a sense of inadequate preparation for the complex environment of the patient care setting. Specific areas of insufficient preparation were identified by Valdez (2008) as lack of self-confidence, discomfort with particular nursing procedures, death issues, organization and time management, ability to decipher early changes in patient conditions, and interdisciplinary and family communication strategies. Procedures most frequently named were cardiopulmonary arrest management, chest tubes management and care, and

placement and care of intravenous, central, and epidural lines (Valdez, 2008). The recognition of areas of need can guide faculty in determining methods and content for scenario development in order to impact students' future preparedness.

The implementation of simulation into nursing curriculum presents its own set of concerns. One concern is the development of resources. The necessary resources are trained faculty, a lab equipped with the expensive simulation products, and contact hours for the students. Additional barriers include the shortage of nursing faculty, aging nursing faculty, and budget constraints (American Association of Colleges of Nursing, 2009). These barriers create the need for creative options to implement simulation into curricula. Currently, there are examples of independent educational institutions building a simulation center and encouraging didactic and clinical instructors to utilize the technology as part of learning in association with the classroom and as part of clinical rotation (Linder & Plusipher, 2008). Another approach is to use partnerships to expand resources. For example, rural areas are collaborating with available stakeholders to establish simulation centers by combining financial and staff resources (Corbett, Miles, Gant, Stephenson, & Larson, 2008; Hyland & Hawkins, 2009). Another example of collaborative efforts can be seen in the work of Arnold, Torsher, Belda, Hurley, Keeher, and Dunn (2008) to standardize a process for starting up a multidisciplinary simulation center connected with the Mayo Clinic in Rochester, Minnesota. The authors concluded, especially for instructors new to the process, simulation education depends on a great deal of planning in order to accomplish a successful educational experience.

Once simulation resources are available, the faculty must be trained in the use of this pedagogical technique. Crucial to this instructional technique is the development of

viable and effective clinical scenarios that will increase students' learning experiences. Simulation objectives should reflect the course and clinical objectives, allow active learning experiences, and promote interactions between students and faculty (Reed, Lancaster, & Musser, 2009).

The National Council of State Board of Nursing (NCSBN) Research Brief (2009) summarizes the advantages and disadvantages for high fidelity simulation. The advantages identified were elimination of direct risk of harm to patients, potential to increase speed of clinical skills to a competent level, team training, standardization of training, opportunity to learn through reflection during debriefing sessions, and potential to contain number and consequences of errors. Disadvantages identified were lack of equipment and environment realism, believability for student during simulation, cost, inadequate time and training for faculty, access to simulation center and/or equipment, negative transfer (when simulation allows incorrect learning due to imperfect simulation), and inability to perform certain assessments.

Both faculty and students report positive feelings when asked about high fidelity clinical simulation (Gore, Hunt, & Raines, 2008). Faculty identify additional advantages for use of simulation as a way to identify gaps in students' knowledge (Lasater, 2007 b) and ability to create a desired experience that may not be possible for every student in the clinical setting (Brown & Chronister, 2009). Faculty can also use the technique as a method of remediation for students whose clinical performance is questionable and in need of increased guidance (Hyland & Hawkins, 2009) Students identify an advantage to learning from the immediate feedback (Lasater, 2007 a), decreased levels of anxiety, and increased levels of confidence (Goldenburg, Anadrusyszyn, & Iwasiw, 2005; Lasater,

2007 a; Brown & Chronister, 2009). Disadvantages for faculty may involve approval of clinical simulation for actual clinical time in the state faculty teach. Indiana currently has no formal approved time for simulation counting toward clinical hours. Students see the short time segments allowed to complete scenario and scenarios participation later in their training as disadvantages to simulation programs (Corbett et al., 2008).

An understanding of the present resources and constraints of the nursing education environment coupled with recognition of the availability of technology encourages evaluation of the usefulness of high fidelity simulation in nursing programs. The study will explore clinical simulation as a valuable tool in the educators' tool box for teaching psychomotor skills and clinical judgment to nursing students.

Background and Significance

High fidelity simulation has enjoyed a long history of success in other disciplines for many decades (Gore et al., 2008). Aviation training has long employed this technique because of its benefit of training the pilot without risking the life of the trainee, trainer, and other innocent bystanders. This is also part of the basis for simulation in medical training. The appeal remains the ability to learn a complex skill in life or death situations without doing harm. In the government issued report, *To Err is Human: Building a Safer Health System* (Corrigan & Kohn, 2000), specific attention was given to concerns for patient safety. This report made many recommendations to improve safety, one of which was utilizing high-fidelity simulators for training medical personnel. Nursing heeded the call and began to investigate computerized patient simulators and nursing education.

Along with the public's knowledge about safety, as highlighted in the *To Err is Human*, additional pressures were building connected with nurse education. Lack of

clinical space has become a daunting problem for schools of nursing. Healthcare settings are demanding competent graduates while offering fewer clinical spaces and a limited number of procedures allowed for students (Corbett et al., 2008). The lack of clinical spaces presents difficulty for schools of nursing who may be competing for the same few spots. Students needing training in specialized areas are often restricted to observation-only experiences and available for a limited number of students. These barriers and the need for more competent graduates has encouraged the development of technologically advanced clinical experience known as high fidelity clinical simulation.

Providing realistic simulations for training nurses in a risk free environment has potential for benefiting students' learning experience and future patients' care. This training is accomplished by the use of simulation to assist learners in performing tasks, exercise critical thinking skills, and learn how to keep patients safe while giving care (Gore et al., 2008). Simulation also shows possible advantages for faculty to recognize student knowledge gaps and misapplications of information by observing students' performance during simulation sessions (Lasater, 2007 b).

Providing experiences that will transfer into the clinical setting is another focus of simulation. This experience is accomplished by the use of high fidelity simulation which allows the student to practice and develop in a safe environment. Transferability involves increasing graduates preparedness and confidence for transitioning from student to nurse role (Chronister & Brown, 2009).

Value can be provided to the educational experience when implementing high fidelity simulation. Clinical simulation can be termed a feasible, dynamic, and compelling

method of teaching that intensifies the learner's experience while increasing confidence levels and augmenting clinical decision making (Reed et al., 2009).

Successful integration of simulation into current teaching practices requires that attention be paid to the importance of active learning, learning preferences, high expectations of the clinical environment, and interaction between faculty and student (Reed et al., 2009). High fidelity simulation (HFS), in particular, incorporates all these conditions with the added benefit of a deepened understanding of didactic principles gained through students' sensory experiences during the simulation (Linder & Pulsipher, 2008).

Simulation as a teaching pedagogy has also shown promise in the development of critical thinking skills. Reflection is an important component of clinical judgment (Tanner, 2006). During reflection on practice, existing knowledge is examined and clinical reasoning improved. Reflection occurs in the simulation session during the debriefing phase (Jeffries, 2005) and is a practical application of Tanner's conclusions about learning to "think like a nurse".

In order to continue developing a body of knowledge that will support the practice of HFS in nursing programs, additional research and replication of research must take place. As more investigation is done, the techniques of successful simulation can be solidified. Options of how best to implement, find funding sources, and train faculty will be affected by establishing the value of this teaching practice for faculty and students. Additional data will serve to encourage further innovation, collaboration, and establishment of best practices in the implementation of HSF simulation into nursing curricula.

Statement of Problem

Newly graduating nurses are expected to perform in an increasingly complex healthcare environment; and there is increasing competition for clinical settings (Corbett et al., 2008). These issues along with concerns for public safety have increased the usage of HFS in nursing education. Implementation of simulation into nursing curricula may increase student preparedness and relieve congested clinical rotation schedules. It is unknown if students and faculty perceive simulation as realistic, transferable, and valuable for application to practice in the clinical setting.

Purpose of Study

The purpose of this study is to evaluate the effectiveness of clinical decision-making skills to determine students and faculty member perceptions of (a) patient and scenario realism using SimMan, (b) ability to transfer knowledge from simulated clinical scenarios to real clinical setting, and (c) value of the simulation in relation to knowledge and skill acquisition at a Midwest community college. This is a replication of the Feingold Calaluce, and Kallen (2007) study.

Theoretical Framework

The general theory that can be applied to this study is Benner's (1984) *From Novice to Expert: Excellence and Power in Clinical Nursing Practice*. Benner's frame work is highly recognized and applied in nursing education and practice. Benner defines skill levels in five phases. The phases are labeled: novice, advanced beginner, competent, proficient, and expert. (Benner, 1984)

Research Questions

1. What are student and faculty members' perceptions of patient and scenario realism using SimMan?
2. Do students and faculty members feel students are able to transfer knowledge from the simulated clinical scenarios to real clinical experiences?
3. Do students and faculty members find using SimMan is valuable in increasing student knowledge and skill acquisition?

Conceptual and Operational Definitions

Realism. Realism is conceptually defined as the degree to which a simulation setting reflects a real clinical environment. This concept is operationalized using three survey items developed by Feingold et al. (2004). These realism-of-the-simulation survey items, such as “the scenario recreates real-life situations,” “space resembles a real critical care setting,” and “SimMan model provides realistic patient.”

Transferability. Transferability is conceptually defined as the ability to transfer skills learned in simulation to the real clinical world. Three transferability-of-the-simulation survey items are used to operationalize this concept. Included in this subscale are items, such as “simulated clinical experience increasing clinical confidence,” “improved clinical competence,” and “prepared for the real clinical environment.”

Value. Value is conceptually defined as the overall value of the learning experience (Feingold et al., 2004). Four value-of-the-simulation survey items are used to operationalize this concept. Included in this subscale are the items, such as “experience is adequate for testing clinical skills and decision making,” “is a valuable learning experience,” “enhances learning,” and “technical skills taught in the course are valuable.”

Limitations

Limitations can be seen in the selection of sample related to size and specific nursing program which can affect generalization to other populations. The participating students may also have had clinical experience prior to the simulation sessions which may dilute the affect of the simulation experience, especially when compared to students with no prior experience. This limitation may skew measurement results. Students can also feel pressure to respond in an acceptable way even though students have been assured the grade is not in question.

Assumptions

1. Faculty value innovative teaching techniques that foster self learning.
2. Students value innovative teaching techniques that aid in students' educational experience.
3. HFS is worth the time and expense necessary to implement into nursing programs.
4. HFS can improve patient safety.
5. HFS can alleviate current issues of shrinking clinical opportunities.
6. Participants will answer survey questions honestly.

Summary

Increased availability of technology, lack of clinical placement opportunities for students, and need for patient safety have caused a surge in nursing schools usage of computerized patient simulators to supplement clinical experiences. The effectiveness of simulators in practice has not fully been established for its transference to practice settings. The body of knowledge is growing, but needs more rigor. This study has

purposes to describe students' and faculty members' perceptions of realism, transferability, and value of HSF in the education domain. The study will be a replication of Feingold et al. (2004) study. The theoretical framework will be provided by Benner's Novice to Expert theory.

Chapter II

Literature Review

Introduction

Examining current research concerning use of patient simulators in nursing education is a challenging endeavor due in part to the lack of depth concerning this topic. The current data on clinical simulation as a valuable teaching method has promising initial results. However, according to the NCSBN research brief the current body of knowledge is more tenuous than one would require for drawing clear and explicit statistical support. This study is an exploratory descriptive study, which is a replication of the Feingold, et al.'s (2004) study. The purpose of this study is to examine students' and faculty members' perceptions of patient and scenario realism, transferability of knowledge from simulated clinical scenarios to real clinical experience, and value of clinical simulation.

Organization of the Literature

The concepts examined in the literature are related to faculty and students' perception of the scenario realism, transferability of knowledge from simulation to real clinical experiences, and perceived value of clinical simulations. This review will first examine the study being replicated. The remainder will be framed using the concepts examined in the study, including realism, transferability and value, and Benner's model of clinical practice, From Novice to Expert, will support the proposed study.

Theoretical Framework

Benner's Excellence and Power in Clinical Nursing Practice is the framework for this study. This framework provides a foundation for formulating appropriate learning techniques for the developing professional nurse. This framework has found application in nursing curriculum, nursing research, and clinical ladder structures for hospitals and clinics. Benner defines skill levels in five phases: novice, advanced beginner, competent, proficient, and expert (1984).

Students move through the phases beginning with students' initial experiences. The novice nurse phase takes the student from no prior experience to the basics of patient care. The student begins to develop concepts that will be key for functioning in the clinical environment by gaining knowledge in the classroom. The student is taking guidelines and assimilating them into usable skills for the clinical setting. The advanced beginner phase is delineated by the student advancing in skills that include abilities to gather and interpret information. Movement in this phase goes from repeating the basics to understanding prioritization and increased awareness of patient issues and planning.

As the student continues to develop skills, the competent level may be reached. This phase is recognized as having increase perception of planning and efficiency. The student exhibits higher level of abstract thinking and engages in better problem solving skills. The student engages in conscious planning with matured perspectives. The competent level carries over from the student role to the new practitioner role. This proficient phase may not be achieved until the student has been in the work place for an extended period of time. This learning level represents full awareness of clinical situations and connected action plans. The expert phase defines the nurse who is practicing with a great deal of

experience, knowledge, and intuition. A nurse practicing at the expert level exhibits well-honed skills and accurately interprets the clinical picture based on the initial assessment of the patient.

Tomey and Alligood (2006) described Benner's theory of clinical practice as attempting to learn and define knowledge crucial to nursing practice; knowledge grows as one practices and develops as situations are encountered and processed. The student will grow in knowledge through the practice of assessments, patient care, and problem solving during simulated clinical experiences. This connects Benner's theoretical concepts to the stated purpose of this study. The creation of clinical realism further supports this linkage by ensuring the students get a clinically viable experience.

Based on an understanding of these various phases of the developing student nurse, this study will examine both the students' and faculty members' perceptions concerning whether simulated scenarios increase preparedness for the real clinical environment and actual patients. The study also examines perceptions of simulation to potential increase clinical skills and decision making abilities which are paramount to safe and competent nursing practice.

Basis of Study

The question of whether simulation is a teaching pedagogy that needs to be added into nursing curricula is addressed by Feingold, et al. (2004). This study included research questions that examined the important concerns about simulation as a teaching pedagogy. First, the authors asked about the concept of realism from the perspectives of students and faculty. Secondly, the issue of perceived transferability of knowledge from

simulation to the clinical setting was explored. The last question focused on perceived value of simulation in increasing student knowledge and skill.

Feingold et al.'s (2004) study used Benner's (1984) Novice to Expert as the conceptual framework. The design was an exploratory/descriptive study using a sample size of 97 BSN students and four full-time faculty members who taught Advanced Acute Care. The researchers chose a 4-point Likert scale survey as the instrument. This survey tool was previously described in literature. The survey was a 20-item evaluation designed to capture perceptions of simulation reality, potential for transference of knowledge from simulation to clinical setting, and value of the simulation experience.

The study evaluated the perceptions of realism, transferability, and value. The findings demonstrated that 86.1% of the students rated the clinical simulation experience as realistic, 76.27% felt the setting was realistic and 64.1% rated the patient as realistic. Transferability had the lowest student agreement. Students' agreement was only 50.8% for the transferability subscale. Value of the experience had the highest student rating with 92.3% of the students agreeing that the simulation experience was a valuable experience.

All four of the faculty members perceived that the simulation was realistic; the knowledge gained in simulation transferred to the clinical setting; and the exercise was valuable. Three of the four agreed that the simulation tested clinical skills. The faculty demonstrated greater agreement in all areas compared to the students. The researchers suggested this may be due to faculty viewing the simulation as experts as opposed to the students' novice viewpoint.

Feingold et al. (2004) concluded that computerized simulation provided value from both the student and educator perspective. Students perceived this as a valuable learning experience and most felt it was realistic. Continued exploration may clarify students' perception that simulated clinical scenarios prepare students for real clinical practice.

Realism

Clinical settings are difficult to obtain for student experiences and ensuring an acceptable clinical experience is important to the development of nurses in training. When seeking to answer issues of limited clinical settings and increasing need for more nurses, it is important to develop simulations that provide realistic clinical experiences. The next three studies were reviewed to examine the idea of realism and simulation in laboratories to help fill this growing need. The first study is Childs and Seeples' (2006) study. This study proposed to investigate success of current design in simulations and future need for designing simulation.

Student satisfaction with the simulation learning experience was explored by Childs and Seeples (2006). A descriptive study utilizing simulation scenarios to teach cardiac arrhythmia recognition and appropriate nursing interventions for patients with cardiac dysfunction was developed using the NLN/Laerdal research framework. A convenience sample of 55 senior level nursing students completed a 13-item NLN/Laerdal survey during a capstone skills lab course. This survey captured the student's perception of usefulness of the experience, feeling about the teaching method, and confidence gained in ability to intervene in the clinical setting if faced with cardiac dysfunction. Included in the survey was a five-point scale to measure specific educational practices

identified as active learning, collaboration, diverse ways of learning, and high expectations.

Students also rated perceptions of the simulation design features categorized as objectives/information, support, problem solving, feedback, and fidelity. The final area students ranked was level of confidence believed they gained through the simulation experience. The students ranked the learning method from this experience higher than any other learning experience. Many students' agreed this was the case even though they viewed the simulated session as stressful. Students indicated, since one of the scenarios involved a code, they increased understanding of the activities involved in a code situation. This realistic event helped students feel less anxious about encountering a code in the clinical setting.

Childs and Stepples (2006) concluded that careful planning and attention to detail were extremely important when developing the scenarios in order to maintain a realistic experience. This means the faculty need to spend adequate time in that endeavor. Students also need adequate time to participate and debrief the simulation sessions to gain optimal benefit. Although Childs and Stepples (2006) began to describe the usefulness of realism in simulation, more data are needed to validate this technique.

Simulation as a method which takes a classroom and turns it into a realistic practice setting for the benefit of the students' educational growth was studied by Schoening, Sittner, and Todd (2006). The purpose of the study was to examine students' perception of the simulated clinical experience as a method of teaching and the educator's role in promoting positive outcomes for these students participating in the simulations.

Schoening et al. (2006) used the Joyce and Wiels 4-phase model for simulation. These phases were described as orientation, participant training, simulation operations, and participant debriefing. Orientation involved explaining the exercise and activities that the student needed to do to prepare for the simulation session. Participant training provided the student with instructions concerning approach for the simulation. Students were to use the same approach they use in the clinical setting when caring for a patient. Simulation operation was the actual simulation sessions that the student participated in while being videotaped and observed by faculty and peers. Participant debriefing followed the simulation session and allowed discussion of the case along with verbalizing feelings about the simulation experience.

The study was set up as a non-experimental descriptive design with a convenience sample of 60 BSN students during their obstetrics rotation. The students all had the usual lectures pertaining to pre-term labor. Each student spent two half-day sessions in a simulation. In one of the simulations the students had to admit a 32-week laboring patient, perform assessment, call the doctor for orders, and develop a care plan. In the second simulation scenario, the patient developed further complications became unstable and required tocolytic treatment and inter-disciplinary interactions. The simulation was evaluated with a 10-item Simulated Clinical Experience (SCE) tool. The SCE was a 4-point scale Likert scale with 4 being equal to “strongly agree”. The students were also instructed to keep a reflective journal.

Students were asked to evaluate whether learning objectives were met by participating in the simulation. Findings demonstrated that the simulation objectives were met with a grand mean score of 3.64. Students’ perception of whether the simulation experience

helped them gain experience for the clinical setting, increased their confidence, and was a satisfying experience had a grand mean score of 3.75. The highest ranked score was students' perception of "the skills I gained during the simulation experience will help me in the clinical setting" which was a 3.80. This speaks to the sense of realism the students assigned the simulation experience.

Comments from reflective journals and questions about realism support quantitative findings. One student commented about the simulation experience compared to experience when at the hospital "This method of learning deals with the whole picture,...when we are working in the hospital (as students), we only get bits and pieces." (p.256). Another student reflected on the simulation with the comment that the simulation "helps with knowing how to act fast in an emergent situation which many of these turn into." (p.256) Students perceptions support the idea that the SCE would help them in the clinical setting and as one student said "make them more comfortable" (p.256) in real world practice. The authors conclude that students' perception of preterm labor SCE is a valuable instructional method (Schoening, et al., 2006).

The supplementation of didactic methodology with high fidelity simulation was also compared with traditional didactic methodology by Brown and Chronister (2009). The purpose of this study was to compare the effect of these two methodologies on students' critical thinking skills and confidence levels in an electrocardiogram nursing course. Brown and Chronister (2009) proposed two hypotheses. The first hypothesis stated that critical thinking and clinical judgment skills would be significantly higher in students engaged in weekly simulations than those receiving just didactic teaching alone. The second hypothesis was that nursing students engaged in weekly simulation activities in

addition to didactic teaching would have significantly higher self-confidence related to ECG rhythm interpretation than students who received didactic only.

Brown and Chronister (2009) used a comparative, correlational research design with a convenience sample of 140 senior level nursing students in a baccalaureate program. Students were randomly assigned to experimental and control groups. The experimental group participated in the didactic course along with weekly simulations which utilized high fidelity patient simulators. The control group received only ECG concepts through classroom lecture during the critical care nursing course.

Brown and Chronister (2009) used the Health Education Systems framework to structure their study. Elsevier's computerized Evolve Electrocardiogram Custom Exam (ECG SimTest) was used to evaluate critical thinking. ECG SimTest was a 30-item multiple choice test. The variable of self-confidence was measured using a researcher developed 5-item questionnaire. Responses were measured using a 5-point Likert type scale ranging from 1-5, with equal to "absolutely helpful".

No statistical differences were found between the groups for critical thinking scores. The second hypothesis was supported with significantly higher for control group ($p < .05$) in that simulators positively affect self-confidence levels which may translate into the clinical setting.

The researchers suggested that higher critical thinking scores were related to higher self-confidence levels and this was reflected in scores that were statistically significant. The researchers concluded that critical thinking was a complex concept and a variety of factors influence the development of this skill. The added realism with the ECG simulations did not provide any statistically difference in the two groups. Brown and

Chronister (2009) recommend further examination into the subject matter by repeated and revised studies to build a broader base of knowledge that will support best practices in simulation and nursing education.

Transferability

Nursing education has been dependent on clinical contact hours to provide new nurses with the training and skills development needed to function in the health care environment. Present issues, such as lack of clinical space, faculty shortages, and necessity for nurses to develop many complex competencies quickly, have encouraged the use of simulation to supplement this education process. More data is needed to validate the use of patient simulation and its ability to adequately prepare student nurses for the professional role. Simulation is not a replacement for clinical experience but a technique for enhancing clinical rotations. Investigation is needed to validate whether simulation has the power to transfer knowledge from the lab to clinical practice.

Cioffi, Purcal, and Arundell (2005) study at the effect of simulation scenarios to determine outcomes on clinical decision making with regard to quickness, data collection, frequency of review of clinical information, making inferences, and confidence levels. Cioffi et al.'s (2005) used a learning strategy engaging simulation, decision making rules and technique known as thinking aloud. The simulations were normal labor situation and a physiological jaundice case. The decision making process was rooted in gaining clinical information, sequencing the information, and applying rules concerning combining information specific to midwifery knowledge base. The thinking aloud technique allowed an examination of the students' process of decision making. The study was a posttest only control group design using 36 midwifery students.

The experimental group received the same lectures as the control group but in addition had two simulation sessions on normal labor and physiological jaundice. The simulations were described as real-life activity that reflected clinical reality.

Coiffi et al. (2005) used audio taped sessions in which the students were told to think out loud as they participated in the simulations. These audio taped sessions were then reviewed using the concepts adopted from Jones (1991) encoding system to categorize information. Both the control and experimental group then completed a posttest to compare scores.

Findings demonstrated a difference between the two groups. The posttest evaluation used a scale from 0% to 100%. For the normal labor scenario the experimental group scored 70% compared to the control group score of 60% with an effect size of .1. The more complex scenario of the physiological jaundice resulted in a wider gap between the two groups with the experimental group scoring 80% and the control group scoring 50% with an effect size of .5.

Coiffi et al. (2005) demonstrated that the experimental group arrived at decisions more quickly, collected more clinical data, revisited clinical data fewer times before arriving at a decision, made fewer inferences, and reported higher levels of confidence. The researchers acknowledged that this study only addressed this issue from a descriptive standpoint but still concluded that simulation strategy benefitted the students who participated in that method. These results suggested that realistic simulation can improve the decision making process in midwifery students. Strong decision making process is essential to competence in the clinical setting.

Larew, Lessans, Spunt, Foster, and Covington (2006) explored simulation as a support to students' problem-oriented assessments, application of appropriate interventions, and interdisciplinary communication. The study used as its framework Benner's (1984) Levels of Competency. The purpose was to evaluate students' performance based on response to clinical cues during the simulation from both the patient simulator and interdisciplinary team members.

Larew et al. (2006) used a descriptive design with a sample size of 190 nursing students. These students participated in simulations that started with a patient at baseline and then added vague prompts. If the student recognized the prompt and intervened, the scenario continued to progress to the next patient problem. If the student did not recognize and intervene correctly, the prompt was repeated at one minute intervals for two minutes until the student responded or until a more specific prompt became necessary. Each patient problem had baseline cues, first level prompt and second level prompt, which clearly identified the patient problem. The escalating prompts were designed to assist the novice nurse's learning process. This simulation design allowed for the progression of an individual through the clinical process paced by their own reaction times.

Larew et al. (2006) concluded that nurses need experiences to develop behaviors for success in the clinical environment. The researchers further stated that clinical simulation allows a mechanism for students to learn in a structured and safe environment. The researchers asserted that simulation has become increasingly available. However, the importance for developing theory-based protocols and the need for more rigor with

reproducible simulation was highlighted to guide the simulation process, competency evaluations, and future research.

Alinar, Hunt, Gordon, and Harwood (2006) used the same theoretical framework as Larew et al. (2006) to compare clinical skills and levels of competence between students receiving traditional clinical training and those receiving traditional clinical training plus simulations. The sample was composed of 99 volunteer nursing students who were randomized into a control and experimental group.

Alinar et al. (2006) used a tool known as Objective Structured Clinical Examination (OSCE). The OSCE was a tool developed in 1975 for assessing clinical competence and is recognized in the literature as a highly reliable and valid tool to evaluate students in the health care arena. Students in both groups improved their clinical performance with the second OSCE with the experimental group generally scoring higher. The experimental group scored 61.71% (95% CI 59.56 to 63.88%) as compared to the control group score of 56.00% (95% CI 53.32 to 58.69%). The more striking result occurred in the level of performance percentage points with the second OSCE, where the control group improvement of 7 percentage points compared to the experimental group's 14.18%. The 7.0 percentage points difference between the groups was highly significant ($p < 0.001$).

Alinar et al. (2006) concluded that there is reason to use simulation in nursing education. This tested training tool allows students to learn through hands on practice which included making mistakes and perfecting individual skills. Students can use this simulation experience to assimilate personal knowledge base which they then take to

clinical practice. Faculty feedback helps guide this process and increases what the students take from the simulation experience.

Lasater's (2007 a) study combined the need to investigate high-fidelity simulators and effect of simulation on critical thinking development. This qualitative study examined the potential for simulation to support both critical thinking and supplement clinical experience. The theoretical framework for this work was Benner's (1984) Novice to Expert.

Lasater (2007a) observed 48 junior level nursing students and videotaped sessions of simulation experiences. Data analysis followed a standard qualitative process identified in literature. The analysis involved organization of the data from tapes, identification of major concepts, and grouping the concepts and themes. This resulted in the development of 13 primary themes which were then consolidated into 5 major codes.

Findings from Lasater's (2007 a) study related to transferability were connected with the code identified as "strengths and weaknesses of high fidelity simulation". Students commented on the simulation process as bringing together the didactic content, readings, and skills learned in the laboratory into a practical clinical environment. The students felt they had to put it all together to resolve the patient issue which required critical thinking. Additionally, students commented that simulation experience increased sense of anticipation or watchfulness for possible events in the clinical setting. Comments from the students that potentially limited transferability with simulation were related to actual limitations connected with the simulator. Examples of this were simulators lack of facial reactions, tissue swelling, and lack of reflexes in neurologic exams.

Lasater (2007 a) continued to research clinical simulation and its potential for the

knowledge gained to be transferred to the clinical setting. This study was conducted to gain further insight into simulations ability to develop clinical judgment in student nurses, while piloting a rubric useful for nurse educators to assess the students' level of critical thinking.

Lasater's (2007 b) exploratory study was described as a qualitative-quantitative-qualitative design. The framework used was Tanner's Clinical Judgment Model (2006). The sample was composed of 39 third year nursing students enrolled in an adult medical-surgical clinical course. These students in groups of 12, reported to the simulation lab one morning a week instead of the facility assigned in the clinical rotation. The students then participated in various roles for simulation scenarios. Nine students observed while three students acted as the health care team giving care to the patient. The roles were alternated to give all students the opportunity to be observer and care giver.

Lasater's study (2007b) described the development of the Lasater Clinical Judgment Rubric (LCJR). The LCJR had four defined categories which were based on Tanner's Clinical Model (2006), including effective noticing, interpreting, responding, and reflecting. Each of these categories identified the student's behavior as beginning level, developing level, accomplished level, or exemplary level. This instrument was used in two weeks of the study and scored only those acting as primary nurse on the health care team to capture the mean clinical judgment score. The mean score for this group was 22.98 points (SD = 6.0). The highest score possible was 44. The observed results were 5-33 points scored. The sample size for these statistics was so small that establishing statistical significance was not possible.

Data were also collected from an eight member focus group comprised of volunteer students. All students were invited to participate. However, only fifteen accepted the invitation and of those only 8 could attend at the scheduled time. This group identified five themes: strength and limitation of high fidelity simulation, paradoxical nature of simulation, intense desire for more feedback, importance of students' connection with others, and general recommendations for improved facilitation of simulation. Lasater (2007b) identified important perceptions from both the student and faculty participants.

Students saw the experience as forcing them to think about the patient's needs, gathering data while taking care of the patient, and increasing understanding of potential interventions available to them. Faculty saw an opportunity to correct knowledge deficits apparent during the simulation that might not easily or quickly surface in the clinical sites. One clear example the faculty cited was the primary nurses' repeated delegation of assessment to other members on the health care team. This consistent practice during the students' simulation highlighted a misconception about assessment. Assessment should be viewed as a continuous process the nurse engages in and not a onetime function to be completed and counted as done.

Lasater (2007 b) concluded that clinical judgment and its development is part of growth in practice in the clinical setting and simulation experience a way to enhance students' learning. Students can achieve learning experiences related to the clinical setting by having clear objectives and feedback when participating in a simulation session. Lasater further stated that if the LCJR is deemed effective in the simulation lab it will also have value in the clinical setting. The researcher acknowledged that more studies using the LCJR are needed. Currently, studies are being conducted to establish a

relationship to simulation in the laboratory and clinical environments and to establish interrater reliability.

Sullivan-Mann, Perron, and Fellner (2009) used an experimental design with pretest and posttest measures. The Roy Adaptation Model (1999) and Benner's (1984) Novice to Expert were used as the theoretical framework. Participants for the study were 53 nursing students enrolled in a medical-surgical rotation. Critical thinking was measured with the Health Sciences Reasoning Test (HRSR), a 33-item standardized computerized test specifically designed to evaluate the critical thinking skills of health science students. The HRST includes five critical thinking skills identified by Delphi experts. The researchers selected this instrument because of its ability to quantify interpretation, analysis, evaluation, explanations, and inference with a built-in scale to determine inductive and deductive reasoning. The HRST has reported reliability and validity.

Findings indicated that control and experimental groups both answered more questions correctly on posttest compared to their pretest. However, the experimental group answered significantly more questions correctly ($p < .05$). In addition, when comparing the groups on deductive reasoning, the result approached significance ($.06 > P > .05$) and was significant for the critical thinking skill of analysis ($p < .01$).

Sullivan-Mann et al. (2009) concluded that an increased number of simulation scenarios results in higher critical thinking scores on the HRST. The researchers offer this as quantified data to add strength to the growing body of evidence for simulation and its usage in nursing education.

Value

All of the above studies could be included in the discussion of value. If data support

that simulation is realistic and transferable, one could also infer it has value in the nursing curriculum. This being understood, it is also important to consider value separately because consideration must be given to issues of costs. Simulation and its cost involve time commitments, resources such as staff and space, and finances. It is, therefore, important to consider the value gained in implementing simulation into a nursing curriculum.

Butler, Veltre, and Brady (2009) examined the use of low fidelity patient simulators (LFS) versus high fidelity simulators (HFS). The purpose of the study was to evaluate differences, if any in learning outcomes for nursing students participating in a pediatric fluid electrolyte simulation scenario. The framework used was Nursing Education Simulation Framework (NESF) created by Jeffries and Rodgers (2007).

This experimental design study utilized a convenience population of 134 nursing students enrolled in an associate nursing program. The simulation was not yet part of the curriculum so the study was conducted with 31 volunteer students. These students were then randomly assigned to either LFS or HFS. The simulation survey tool used was developed by the NLN and Laerdal. The survey instrument was a 5-point Likert scale with 5 equal to “strongly agree”. Students responded to three categories concerning the simulation including simulation design, educational practice, and student satisfaction and self confidence.

Results showed that the HFS group perceived more of the simulation design features existing in the high-fidelity simulation experience as compared to the perception of the LFS group. In the category identified as educational practice, a significant difference was found between the mean total scores (LFS M=70.44, HFS=77.27 $t=-3.50$, $p=.003$). On

issues of importance of education practice a significant difference was also found. (LFS $M=68.38$, HFS= 77.60 $t=-4.36$, $p=.001$). Productive learning time was rated 100% by the HSF group as compared to 63% by the LSF group. Ratings connected with students' perception of importance of simulation were similar with a 100% rating from the HSF group for strongly agreed and 50% strongly agreed from the LSF group. Both groups gave simulation and the variety of learning it offered high scores but again the HSF rated higher than LSF at 100% and 75% respectively.

Butler et al. (2009) concluded that value can be established with both. HSF and LSF. However, those who used HSF perceived greater value. This was associated with the higher HSF rating for greater problem solving process and increased realism, both of which contributed to students' judgments that the time spent was more interactive and productive. The researchers concluded that the additional costs involved in the HSF scenarios are justified. Further, evidence was provided that the NESF can successfully be used as a framework to integrate simulations into a nursing curriculum. Additional studies with larger sample sizes and multiple sites will help validate these findings.

Using a comparative descriptive study, Goldberg et al. (2005) investigated perceived levels of student confidence after simulation in the classroom with a sample of 66 third year BSN students. The question asked was whether students' self-efficacy score would be higher concerning health teaching after participating in a classroom simulation scenario. Health teaching was designed in phases to reflect the students' capability for assessment, planning implementation, and evaluation with interaction with the patient in a clinical environment. Also explored was how the students would perceive simulation in the classroom and its effectiveness for building their personal confidence.

Goldberg et al. (2005) used Bandura's self-efficacy theory for its framework. Bandura hypothesized that confidence in one's self is instrumental to accomplish assigned functions or responsibilities. When an individual has confidence in self, this confidence translates into ability to approach and complete tasks in the clinical setting.

A two part 63-item self-efficacy questionnaire was developed using simulation literature and the faculties teaching experience. Content validity was derived from three nursing education experts. Face validity for the tool was accomplished by piloting the tool with 7 senior level students prior to the 2005 study. This instrument was designed to allow the students to rate their level of confidence regarding health teaching in regard to stages of the nursing process before and after the simulation workshops. A significant increase in self-efficacy scores after participating in the workshop were reported as compared to scores from before the workshop. The pretest mean of 2.96 was compared with the post test mean of 3.55 and reflected a significantly higher overall confidence related to health teaching ($p < 0.001$).

Goldberg et al. (2005) concluded that simulation strategy increased confidence for the student in regard to the phases of health teaching through the active participation of the activity and successful completion of the associated tasks. They also concluded that the simulation scenario enhanced other behaviors connected with learning, such as observation by the student and encouragements offered by the faculty. Feedback in a safe environment enhanced communication and decreased students' stress levels.

Summary

Educating future generations of competent nurses has always been a challenge. Currently, adding to those challenges are the issues of fewer clinical sites and clinical sites which restrict potential hands on experiences for the student. This decrease in numbers of clinical sites along with the rapid growth of technology has offered a unique opportunity to develop creative solutions for teaching new nurses. One of the creative solutions is high fidelity simulations with specially designed scenarios. Researchers have begun to build a body of knowledge to help guide this process for nursing instruction. Reviewing the literature concerning simulation opens many avenues for discussion and investigation. Need for more research to strengthen strategies can clearly be seen when it comes to simulation practices and applications to nursing curriculum

Realism in scenario simulations and its effectiveness for student learning was identified by Childs & Stepples (2006) and Schoening et al. (2006). Brown & Chronister (2009) identified realism in simulation as a potential for increasing confidence levels in students concerning their clinical skills. Larew et al. (2006) and Aliner et al. (2006) discussed using simulation scenarios to increase skill and competence levels using Benner (1984) as their framework. These researchers found increased levels of competence which could have the potential to transfer into the clinical environment. In two separate studies Lasater (2007a, 2007b), identified issues of critical thinking and in one of the studies identified a potential tool for quantifying the results of simulation learning. All of these studies lend credence to the value of simulation as a teaching tool based on obtained results. Goldenburg et al. (2005) identified students' increased level of self-efficacy when exploring the value of simulation and its effect on health teaching.

Butler et al. (2009) recognized that value can be assigned to simulation strategies but students rated high fidelity simulation significantly higher than low fidelity simulation. This is important to consider because of the high price associated with the higher fidelity simulation strategy.

Understanding the students' perceptions during simulation and the faculty perceptions, allows nursing educators to make learning more personal and focused. If concepts are thoroughly learned in the simulation lab, this experience can bolster clinical judgment which in turn will translate into more knowledgeable, prepared, practitioners. Research currently has evidence that simulation can give the student a realistic, transferable, and valuable experience for learning.

The literature reviewed included qualitative and quantitative approaches. Most researchers agreed that more quantitative research is needed to establish best practice when using simulation as a teaching method. The literature reviewed included several different tools to gather data. The specific tools were survey, pretest/posttest, audio and video tape, OSCE, HSRT, SCE, and LCJR. A variety of study frameworks also were included in the literature review. The frameworks identified were Benner's Novice to Expert, Bandura's Self-efficacy, Roy Adaptation Model, NLN/Laredal project framework, Joyce and Weils 4-phase model for simulation, Health Educations Systems Critical Thinking, Tanner's Clinical Judgment Model, Simulation Strategy Model, and NESF. This varied collection of evidence validates that simulation works with a variety of approaches already known to nursing education and works with new evolving frameworks.

Understanding this potential for simulation in nursing education helps to justify cost

for the simulation lab. Added to this is the potential for students to hone their skills in a risk free environment. The challenges of time and expense may be overcome when such strong evidence is surfacing for the value of simulation. Simulation should not take the place of clinical experience, but can offer relief to the problems connected with fewer actual clinical sites and more stringent guidelines connected with those sites. Simulation can give students opportunities to perform activities which develop their clinical judgment.

Chapter III

Methodology

Introduction

Clinical simulation is currently under investigation to determine value as a teaching pedagogy. Literature has shown potential for this teaching method to increase student confidence, skill, and development of decision making process. This study is a replication of Feingold et al.'s (2004) study. Feingold et al. used baccalaureate nursing students for the study. This study will use associate nursing students (ASN). The purpose of this study is to examine students' and faculty members' perceptions of patient and scenario realism, transferability of knowledge from simulated clinical scenarios to actual clinical settings, and value of clinical simulations. This chapter describes the population, sample, procedure, measurement, methodology, and design governing this study.

Research Questions

1. What are student and faculty members' perceptions of patient and scenario realism using SimMan?
2. Do students and faculty members feel students are able to transfer knowledge from the simulated clinical scenarios to real clinical experiences?
3. Do students and faculty members find using SimMan is valuable in increasing student knowledge and skill acquisition?

Population, Sample, and Setting

The population will include ASN students from two consecutive semesters enrolled in Medical Surgical Nursing of the Adult and six faculty members at Midwestern Community College during one academic year. The predicted sample size will be 60 nursing students participating in a planned simulation day. Inclusion criteria will include nursing student in good academic standing who are enrolled in the designated course. No exclusion criteria will be applied. Collected demographic data will include age, gender, self-reported grade point average, and ethnicity.

The population could be considered representative of the target population in that findings could be generalized to a wider population of associate level nursing students. The limitation could be related to adequate sample size since participation will be limited by enrollment.

Protection of Human Subjects

This study will be submitted to the institutional review boards (IRB) of Ball State and Ivy Tech Community College for approval prior to conducting the study. Ethical issues will be addressed through adherence to the principles for ethical research. The subjects will be required to participate in the activities since they are embedded in the course however students may request that their data not be included in the study data. The subjects will understand that participation in the simulation is part of completing course objectives. Attendance will be required and recorded as pass/fail based the individual participation. The survey will be anonymously completed and will be without penalty related to course grade.

Procedure

After receiving approval from both IRBs, the research project will be presented to the nursing school faculty. The simulation scenarios and survey tools will be reviewed by faculty and simulation days will be scheduled in the laboratory. The students will have two simulation scenarios during the eight week course. One will occur half way through the course and one at the end of the eight weeks. The scenarios will involve an elderly female patient with chronic pulmonary disease (COPD) complicated with pneumonia. Both simulations will use the same patient and patient history but problems will vary. Students will receive role assignments the day before the simulation. The day of the simulation students will receive report and current lab values from a faculty member. Clinical cues will be displayed on the computerized bedside monitor and correlate with SimMan's assessment values. The laboratory will be staged with suction equipment, oxygen, and intravenous equipment to increase a realistic hospital environment. SimMan will have verbal responses programmed to correspond with the 10 minute scenario. The simulations will be set up to reflect a patient who is clinically deteriorating.

The student will introduce self to SimMan and start assessment and patient care. The patient will begin to decline and the student must identify the problems, prioritize the problems, and act to resolve the problems. The simulation will allow the student to communicate to patient, patient's family, and other healthcare team members. At the conclusion of this experience, the student will debrief with the faculty and fill out the survey related to the experience.

Research Design

This study is described as an exploratory/descriptive design. This design is acceptable when building on a body of knowledge that is not fully defined (Burns & Groves, 2005). Since no independent variable is being manipulated and the design is seeking to measure a variable in its natural setting, a convenience sample will be obtained. The addition of simulation to the existing medical surgical nursing course will allow students to experience this simulation technology-based teaching strategy and then comment on students' perception of the experience. Survey data concerning students' and faculty members' perceptions of the experience will be collected and analyzed to add to what is already known about the current educational practice of simulation. Since the students will not be completing the course during the same semester or same portion of the semester, the study will be conducted in four groups. Group one will participate during the first eight weeks of the fall semester; group two will participate in the second eight weeks of the semester. Groups three and four will have the same arrangement in the spring semester. This arrangement will accommodate 15 students per the eight week timeframe. One faculty member will be assigned to five students to for the actual simulation activity.

Instrumentation, Reliability, and Validity

Demographic information will be gathered on all the incoming students who plan to complete the medical-surgical course in one of the two designated semesters. This survey will include gender, age, self-reported GPA, and ethnicity. The students and faculty will fill out a satisfaction survey developed by Feingold et al. (2004) at the completion of each simulation session. This survey is a 20-item Likert type evaluation scored on a 4-point

scale. The response selections range from 1 = strongly disagree to 4= strongly agree. This tool was selected to evaluate agreement by calculating the mean with standard deviation to establish a percent of agreement. The percent of agreement will be categorized by the subscales of transferability, realism, value, and individual items. The individual items will be: I was prepared for testing with SimMan; Pace and flow reflects real clinical environment; Comfortable room temperature; I needed orientation before testing; Adequate room lighting; Decision making taught was valuable; and Skills taught in course are valuable. No use of neutral category will be used to ensure participants make selections reflecting either a negative or positive perspective. Faculty will fill out a similar survey.

Instrumentation reliability is seen in the selection of a tool that mirrors previously tested data collection tool applied to simulation in medical education. Selecting a survey tool previously used in research will increase reliability. Validity of the instrument involves ensuring that the survey reflects accurate understanding of realism, transferability, and value.

Measures of Data Analysis

Chi-square testing will be performed on the demographic data to establish no significance differences in the groups. ANOVA testing will be used for the statistical analysis. Group membership will be the independent variable and student agreement to realism, value, transferability, or individual survey item will be the dependent variable. Each score will be separated by group then summed. A mean will be calculated for four groups along with the 3 subcategories. The subcategories are the value of the experience, the transferability of the skills and realism. A one-tailed test will be performed for

interpreting the results. The level of significance will be .05. Since the total number of groups will be 4, post hoc analyses will be conducted to determine locations of differences between groups (Burns & Groves, 2005).

Summary

This chapter has been a discussion of the methods and procedures planned for use in this study. The specific concepts are student and faculty perceptions of realism, transferability, and value of simulation scenarios. An exploratory descriptive study design will be used with a predicted sample size of 60 students. Demographics and a satisfaction survey will be used to collect the needed data. Data will be analyzed using ANOVA one tailed testing with a .05 level of significance. This study is a replication of the Feingold et al. (2004) study and is an attempt to add rigor to the current body of knowledge concerning simulation and nursing education.

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APPENDIX A - RESEARCH

Source	Problem	Purpose Research Questions	Framework or Concepts	Sample	Design	Instruments	Results
Feingold Calaluce, & Kallen, (2004)	It is unknown whether students and faculty perceive simulations as realistic, transferable, and valuable for application to practice in the clinical setting.	Determine both faculty and students' perception of the realistic nature of simulations and the value and application to practice Student and faculty view of realism? Is knowledge transferable from simulation to clinic? Is it valuable in increasing student knowledge and skill acquisition?	Novice to Experts Benner (1984) Progressing through Levels of Competency	Small sample of 97 BSN student And 4 full time faculty who teach Advanced Acute Care	Exploratory /Descriptive	Survey tool described in the literature by Halamek, Kaegi, Gaba, Sowb, and Smith (2000). 20-item evaluation with a 4-point Likert scale to measure perception of simulation reality, potential for transference of knowledge from simulation to clinical setting, value of experience.	Realistic clinical experience student (86.1%), setting (76.27%), and patient (64.1%). Transferability had lowest agreement students (n = 65, 50.8%) (Mean 2.52). Less than 50% of students Value had the highest agreement students (n = 65, 92.3%) (Mean 3.04). Faculty results were 100% for transferability, realism, and values with exception of 75% for tested clinical skills.
Childs, & Stepples (2006)	It is unknown whether students who use simulation value of that as an effective learning experience.	Determine successes of simulations and what the needs for the future are. What are the successes with designed simulation? What	NLN/ Laerdal research project framework	55 nursing students One of 8 schools participating in NLN 3 year multi-site national study	Descriptive Design	Simulations designed by NLN/Laerdal instruments designed to measure student's satisfaction with learning	Students rated the experience as overwhelmingly positive. The learning rating was ranked higher than any other learning experience for many students even

Source	Problem	Purpose Research Questions	Framework or Concepts	Sample	Design	Instruments	Results
		needs were identified for future simulation experience?				experience. Results from 13 item scale asking students about confidence gained, usefulness of experience and feeling about teaching method.	though they agreed the experience was stressful.
Schoening, Sittner, & Todd (2006)	It is unknown whether students' perception of simulated clinical experiences as a learning method is valuable.	Purpose of the study was to examine students' perceptions of a simulated clinical experience as a method of instruction and the educators' role in promoting positive outcomes for these students.	Joyce and Weils 4-phase model for simulation (1996)	Convenience sample of 60 BSN students during Obstetrics rotation	Non experimental Descriptive Design	10 Item evaluation tool of the Simulated Clinical Experience (SCE) which used a 4 point scale ranging from 1 "strongly disagree" to 4 "strongly agree" Weekly Reflective journals.	Completed and usable evaluations were N=57 The grand mean scores for meeting the simulation objectives was 3.64. The grand mean for students' perception of the SCE was 3.75. Qualitative data from journals categorized and aligned with Joyce and Weils simulation categories.
Brown, & Chronister (2009)	It is unknown what effect simulation will have on students' critical thinking and confidence	Purpose of the study was to quantify effects of High fidelity simulators compared to	Critical Thinking framework Health Education Systems	Convenience sample of 140 senior level baccalaureate students	Comparative correlational research design.	Variable of Critical thinking evaluated using Elsevier's computerized Evolve	Results showed no statistically significant difference in the critical thinking scores of the control

Source	Problem	Purpose Research Questions	Framework or Concepts	Sample	Design	Instruments	Results
	levels?	traditional method of teaching when looking at critical thinking skills and confidence levels of students.	(Morrison, Nebert, Flick, 2006).	enrolled in a critical care course beginning in spring 2007 to spring 2008.		Electrocardiogram Custom Exam (ECG SimTest) 30 item multiple choice test. Variable of Self confidence use a researcher developed 5-item questionnaire with a 5point Likert-type scale 1-5 1= not helpful to 5= absolutely helpful.	and treatment group which did not support the 1 st study hypothesis. The 2 nd hypothesis regarding confidence revealed a significant difference in levels of confidence when comparing the control and treatment group.
Cioffi, Purcal, & Arundell (2005)	It is unknown whether simulation has an effect on clinical decision making for students.	Purpose was to determine if simulation scenarios had an effect on clinical decision making connected with quickness of decision making, collection on data, frequency of reviewing clinical information, making inferences, and confidence levels.	Simulation Strategy	36 midwifery students entering the third semester diploma program	Posttest only control group Design	Audio taped sessions reviewed using adopted Jones (1991) encoding system to categorize information	Experimental group arrived at decisions more quickly, collected more clinical data, revisited the clinical data fewer times, and made fewer inferences group. Scale used 0% - 100%. Scenario one-Exp group=70% Control= 60% Scenario two-Exp group=80% Control =50%

Source	Problem	Purpose Research Questions	Framework or Concepts	Sample	Design	Instruments	Results
Larew, Lessans, Spunt, Foster, & Covington (2006)	Students need to identify emerging clinical problems, develop strategies for patient management, and practice collaborative problem solving.	Exploration of protocol structures for nursing clinical simulations Can protocols with simulation support students in development of problem-oriented assessment, identifying appropriate interventions and practice interdisciplinary communication skills?	Levels of competency/ Benner (1984)	190 adult health students University of Marilyn Baltimore Nursing School	Descriptive /Mandatory simulated experience while being observed. Scripted prompts escalated during scenario progression from both patient and interdisciplinary team members.	Real-time cues based on student responses with escalating cues used for competency evaluations. Students were scored based on recognition of problem and action taken. If no recognition after 2 mins. of vague prompt moved to specific prompt. Specific prompted repeated at 1-2 mins. intervals until student recognized problem or simulation time complete.	Benner's concepts provided a philosophical basis for interactive clinical simulation finding responses based on prompts. The prompts ranged from vague to specific in order to evaluate students competencies while allowing for individualized progression with problem solving, assessments, interventions, and interdisciplinary communication skill.
Alinier, Hunt, Gordon, & Harwood (2006)	It is unknown if scenario-based simulation is an effective teaching method to improve student clinical skills and	Explore effectiveness of simulation scenario and its value to student learning of skills and levels of competence	Levels of competency/ Benner (1984)	99 volunteer undergraduates participating in 2 nd year of a diploma nursing program in	Randomized Control/Experimental groups using a pretest/posttest design.	Use of 2 Objective Structured Clinical Examination (OSCE) initially of both control and experimental	Comparison of the 2 group's scores concluded that the experimental group received higher scores than the control group. Experimental group

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	competence.			the United Kingdom.		groups with a reassessment after completion of 6 month of traditional classes or traditional classes with simulations.	scored 61.71% (95% CI 59.56 to 63.88) Control Group 56.00% (95% CI 53.32 to 58.69) The difference between performance from the first OSCE to 2 nd was Control improvement of 7.18 % compared to Experimental improvement of 14.18%
Lasater (2007a)	It is unknown if experience with high-fidelity simulators will help novice nurses promote skills and critical thinking.	Examine the experiences of students using high fidelity simulators. How does the experience of high-fidelity simulation on novice nursing students foster development of critical thinking?	Benner's novice to expert (1984)	48 junior level students enrolled in Nursing Care of the Acutely Ill Adult	Qualitative/Grounded Theory	Observation and focus group with video- taped session that lead to the development of 13 primary themes which were then condensed to 5 major codes.	Focus group data was used to identify 13 primary themes based on researchers' review of responses to open-ended questions and student comments. Researcher also reviewed the audiovisual recording.
Lasater (2007 b)	It is unknown whether high-fidelity simulation will effect clinical	Purpose of the study was to describe students' response to simulations within	Tanners' Clinical Judgment Model (2006)	39 third year nursing students enrolled in adult	Qualitative, Quantitative, Qualitative Exploratory Design	Quantitative instrument was Lasater Clinical Judgment Rubric (LCJR).	Mean clinical judgment score of 22.98 points (SD = 6.07). Possible points were 44 the

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	judgment.	Tanner's (2006) Clinical Judgment Model and develop a rubric for simulation using Tanners' model.	medical-surgical clinical course			Qualitative instrument 8 Member focus group	observed range was 5 to 33. Descriptive and ANOVA performed on dependent variables to test statistical findings. Five themes - -strength and limitations of high-fidelity simulation -paradoxical nature of simulation. -intense desire for more feedback -importance of students' connection with others -general recommendations for improved facilitation
Sullivan-Mann, Perron, & Fellner (2009)	It is unknown whether critical thinking abilities will improve when students' experience repeated simulation experiences.	Purpose of this study was to investigate effects of simulation teaching strategies on the students critical thinking skill and determine if critical thinking	Roy Adaption Model (1999) and Benner's Novice to Expert (1984)	53 nursing students enrolled in Nursing II (Med-Surgical rotation)	Experimental Design using pretest/posttest	Health Sciences Reasoning Test (HSRT)	No significant difference between experimental and control groups at pretest ($p > .05$) Posttest findings: experimental group answered significantly more correctly on post

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		improved in ADN students after multiple exposures to clinical simulations.					than pretest ($p < .05$). Control though improved did not significantly ($p > .05$).
Butler, Veltre, & Brady (2009)	It is unknown whether there is a difference in students' perception of the active learning process when using low-fidelity simulation compared to high-fidelity simulation.	Purpose of this study was to investigate differences in students' perception of learning process when comparing low-fidelity and high-fidelity simulations.	Nursing Education Simulation Framework (NESF) Jeffries and Rodgers (2007)	Sample 31 volunteer nursing students enrolled in ASN program.	Experimental design utilizing random assignments for participants.	Simulation Survey tool developed by the NLN and Laerdal. Instrument used a Likert 5 point scale. 1=Strongly disagree to 5=Strongly agree	NESF Simulation Design items: LFS $M=86.93$ HFS $M=97.20$ Realism LFS=31.3% HFS=87% based on score of 5. Problem solving receive LFS 87.5% HFS 87% Educational practice LFS $M=68.38$ HFS $M=77.60$ Productive learning time LFS 63% HFS 100% Learning variety LFS 75% HFS 100% Satisfaction and Self-confidence LFS $M=55.33$ HFS $M=61.86$

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Goldenberg, Andrusyszyn, & Iwasiw (2005)	Students don't feel confident with simulations related to health teaching.	Determine effect of classroom simulation on students self-efficacy Will simulation increase students perception of self-efficacy related to health teaching?	Self-efficacy Bandura	22 third year BSN students from University in SW Ontario, Canada	Comparative Descriptive/ pre and post survey	Researcher developed 2 -part 63- item Self-Efficacy Questionnaire to measure degree of self-efficacy pre and post workshop using a 4-point Likert scale ranging from 1 = "completely lacking confidence" to 4 = "very confident"	Significant increase in self-efficacy scores ($p=0,001$) post workshop as compared to pre workshop. Pre-test means recorded at 2.96 compared to post test mean of 3.55 reflecting greater overall confidence related to health teaching ($p<0.001$).