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Simulation and Curriculum Integration: Does Simulation Improve Clinical Competence

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Simulation and Curriculum Integration: Does Simulation Improve Clinical Competence

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Abstract

Background: While simulation is a widely used pedagogy in nursing education, there is inconsistent evidence regarding its effectiveness in demonstrating positive learning outcomes. Therefore, further research is needed to establish the effectiveness of simulation in developing clinical competence, and the incorporation of this pedagogy into nursing curricula. **Purpose:** To explore how the integration of high-fidelity simulation into nursing curricula influences learning outcomes. More specifically, to examine differences in clinical competence as measured by the outcomes: knowledge, skills, critical thinking, and clinical judgment in nursing fundamental students taught using high-fidelity simulation versus traditional instructional methods. **Design:** A two-group time series experimental design was used to evaluate the impact of traditional or high fidelity simulation instructional methods on improving clinical competence at three time points. **Findings:** The results reveal significant improvements in knowledge, skills, and clinical judgment over time. However, instructional method did not have a significant effect on these learning outcomes. There was a significant interaction between time and instructional method on improving critical thinking, as both groups demonstrated significant improvements from pre to post intervention. The traditional group showed a significant decline in critical thinking ability 3 weeks post intervention, while the simulation group remained unchanged. **Conclusions:** The findings of this study support the inclusion of high-fidelity simulation into nursing curricula to facilitate improvements in clinical competence. This study provides evidence that high-fidelity simulation is a better approach than traditional instruction in developing critical thinking, and is analogous to traditional instruction in improving all other domains of clinical competence.

Chapter 1. Introduction

Background and Significance

New graduate nurses are entering the workforce at a rapid rate and obtaining positions in high acuity settings. Effective time management, the ability to multi-task, and providing care for patients with more complex needs are among many obstacles that novice nurses must overcome to transition into their new role. Unfortunately, only 30% of new graduate nurses have achieved clinical judgment skills consistent with the expectations of an entry-level nurse (Del Bueno, 2005). This finding regarding new graduate clinical judgment is reinforced by a recent study of hospital administrator perceptions of new graduate nurse competence that revealed that only 10 percent were considered to be adequately prepared for the role (Berkow, Virkstis, Stewart, & Conway, 2008). Therefore, it is imperative that nursing programs reevaluate their curricula to ensure that the development of clinical competence is facilitated through various teaching modalities.

The National league for Nursing (NLN) has expressed the need for education reform to meet current healthcare demands. In their 2003 position statement, the NLN appealed to nurse educators to review and restructure nursing curricula to incorporate new technology and innovative teaching strategies in order to facilitate learning (National League for Nursing, 2003). Moreover, all nursing faculty were asked to develop and conduct research on the most effective innovative teaching strategies that maximized students' ability to learn clinical practice and successfully manage higher acuity patients (National League for Nursing, 2003). Consequently, simulation has emerged as the ideal innovative pedagogical approach to remedy the lack of clinical experiences available for students to establish competence prior to graduation.

Simulation provides an opportunity to standardize a patient encounter so that all students receive similar learning experiences (Medley & Horne, 2005). Moreover, students have the ability to apply decision-making and critical-thinking skills to patient scenarios in a controlled environment without compromising patient care (Gates, Parr, & Hughen, 2012). Ultimately, simulation offers an opportunity to improve student-learning outcomes by facilitating the integration of theoretical knowledge and skills (Thompson & Bonnel, 2008).

The use of simulation in nursing education has grown exponentially over the past decade. The initial catalyst to this transition was the endorsement of simulation by the National Council State Boards of Nursing (NCSBN). In their 2005 position statement, the NCSBN indicated that pre-licensure nursing programs could use innovative teaching strategies such as simulation in addition to clinical experience (National Council State Boards of Nursing, 2005).

Simulation is now the emerging teaching strategy to support clinical education in programs with rapidly increasing admission rates. Over the past decade, nursing programs have seen a significant increase in student enrollment. A recent survey conducted by the American Association of Colleges of Nursing found that enrollment in BSN and RN to BSN completion programs from the 2013 to 2014 academic year demonstrated a 4.2% and 10.4% increase, respectively (American Association of Colleges of Nursing, 2015). This rise in the number of nursing students has contributed to the challenge of obtaining adequate clinical placements, thus forcing schools to turn to simulation.

Finding qualified faculty to teach in the clinical setting has presented yet another issue in nursing education. The American Association of Colleges of Nursing (American Association of Colleges of Nursing, 2015) revealed that two-thirds of nursing schools cited having an inadequate number of faculty available to teach as the rationale for rejecting qualified prospective students. Another study indicated that 65.9% of institution vacancies were for faculty that would have both clinical and lecture responsibilities (Li, Stauffer, & Fang, 2016).

The combined effects of deficiencies in faculty pools, expanding program enrollment, and pressure from the NLN and NCSBN to provide innovative instruction, have required nursing schools to shift their focus toward using simulation as a teaching strategy. Consequently the literature has focused on the best methods of curricular integration, and determining if simulation is a reasonable substitute for clinical to improve learning outcomes. Data presented in a recent NCSBN survey reflected that 55% of nursing programs use simulation in five or more courses within the curriculum (Hayden, 2010). Current recommendations support the replacement of up to 50% of clinical time with simulation (Hayden, Smiley, Alexander, Kardong-Edgren, & Jeffries, 2014).

Problem Statement

While the use of simulation in nursing education is a growing trend to improve clinical related knowledge and skills among nursing students, research provides inconsistent objective evidence that simulation is an effective pedagogy. Historically, much of the literature has focused on student and/ or faculty perceptions of simulation effectiveness. This gap in the literature makes it clear that further research must be dedicated toward determining the actual learning outcomes of simulation, and how to effectively integrate simulation into nursing education to improve clinical competence.

Purpose of the Project

The purpose of the current study was to: 1) explore how the integration of high-fidelity simulation using course and program objectives in a nursing fundamentals course influences student learning outcomes, and 2) examine the differences in clinical competence as measured by knowledge acquisition, skills acquisition, critical thinking, and clinical judgment between student learners taught using high-fidelity simulation and those that received the traditional instructional method.

Research Questions

This study addressed the following research questions:

1. Is there a difference in knowledge acquisition between student learners that are taught using high-fidelity simulation and those that receive the traditional instructional method?
2. Is there a difference in skills acquisition between student learners that are taught using high-fidelity simulation and those that receive the traditional instructional method?
3. Is there a difference in critical thinking ability between student learners that are taught using high-fidelity simulation and those that receive the traditional instructional method?
4. Is there a difference in clinical judgment between student learners that are taught using high-fidelity simulation and those that receive the traditional instructional method?

Conceptual Definitions

In order to have a thorough understanding of clinical competence as it applies to simulation, it is imperative to define the term and its constituents.

- Clinical competence is defined as “the acquisition of relevant knowledge, the development of psychomotor skills, and the ability to apply the knowledge and skills appropriately in a given context” (Decker, Sportsman, Puetz, & Billings, 2008, p. 75). It contains four main components: knowledge acquisition, skill acquisition, critical thinking, and clinical judgment.

- Knowledge Acquisition is defined as "the knowledge that one acquires through both informal and formal processes, and serves as the basis of attitude formation and decision making about health topics" (Warren, Mendlinger, Corso, & Greenberg, 2012, p. 69).
- Skill Acquisition is described as "a gradual transition from rigid adherence to rules, to an intuitive mode of reasoning that relies heavily on deep tacit understanding" (Adolfo, 2010, p.3).
- Critical Thinking is outlined as the "process of actively and skillfully conceptualizing, applying, analyzing, synthesizing and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning or communication, as a guide to belief and action" (National Council State Boards of Nursing, 2005, p.2).
- Clinical judgment is described as

  The art of making a series of decisions to determine whether to take action based on various types of knowledge. The individual recognizes changes and salient aspects in a clinical situation, interprets their meaning, responds appropriately, and reflects on the effectiveness of the intervention (Meakim et al., 2013, p. S6).

- Student learning outcomes are defined as "measurable results of the participants' progress toward meeting a set of objectives" (Meakim et al., 2013, p.S7). The student learning outcomes measured in this study are changes in knowledge acquisition, skills acquisition, critical thinking, and clinical judgment.
- High fidelity simulation is defined as "experiences using full scale computerized patient simulators, virtual reality or standardized patient that are extremely realistic and provide a high level of interactivity and realism for the learner" (Meakim et al., 2013, p.S6).
- Traditional instructional method incorporates the use of lecture, video, and instructor demonstration of skills, to facilitate the development of knowledge, skills, critical thinking, and clinical judgment.

Operational Definitions

For the purposes of this study the conceptual terms were operationally defined.

- Student learning outcomes will be measured by changes in knowledge acquisition as measured by pre-and post-test performance, skills acquisition and critical thinking as measured by Creighton Competency Evaluation Instrument, and clinical judgment as measured by the Lasater Clinical Judgment Rubric
- Clinical competence is measured by demonstrating improvements in all four student learning outcomes: knowledge acquisition, skills acquisition, critical thinking, and clinical judgment as measured above.

Chapter 2. Review of Literature

An extensive review of the literature was conducted to identify relevant studies that examined the integration of high-fidelity simulation into nursing curricula. Additionally, the literature search examined articles related to the effectiveness of this teaching modality on clinical competence, as evaluated by the outcomes: knowledge acquisition and retention, skills acquisition and retention, critical thinking, and clinical judgment. All retrieved articles were evaluated using the criteria presented in the researcher developed scoring key.

The scoring key consisted of a twenty-five-point scale, to establish relevance related to initial research questions. Each article was evaluated on nine categories: article focus, sample demographics, stage in program, sample size, randomization, evaluation method of learning outcomes, interobserver reliability, internal consistency of evaluation tool, and content validity. Articles with a score of ten or less were excluded, as they lacked critical elements in their research design and analysis that could effectively answer the research questions.

The Article Focus category aimed to ensure that the focus of the study was on curriculum integration and the evaluation of high fidelity simulation. Articles would receive two points if curriculum integration was addressed and high fidelity simulation evaluated; one point if curriculum integration was not addressed and high fidelity simulation evaluated. Articles were automatically excluded if the focus was on any of the following: exclusively on curriculum integration of simulation, simulation design, development or analysis of an evaluation tool, evaluation of prebriefing or debriefing, evaluation of standardized patients/actors, evaluation of medium, low fidelity or virtual simulation, or the evaluation of multiple combinations of simulation fidelity.

To ensure the sample reflected prelicensure nursing students enrolled in a baccalaureate program, the Sample Demographics category was developed. Articles received two points if the sample was comprised of entry level to practice students not enrolled in an associate's degree program; one point if the sample contained entry level students enrolled in a generalist master's program, or if the program was not specified. Articles were automatically excluded if the sample consisted of: associate degree nursing students, licensed health professionals, advanced practice nursing students, or students enrolled in programs outside of the nursing discipline.

The Stage in Program category was designed to establish a sample of students enrolled in fundamental nursing courses. Moreover, students at earlier program stages have less influence of clinical and other simulation exposure influencing learning outcomes. Articles achieved three points if the sample consisted of freshman through junior students, or students enrolled in a fundamentals or a medical surgical course; two points if the sample consisted of senior students or students enrolled in specialty, advanced, or elective courses; and one point if sample consisted of students enrolled in a nonclinical course, students at different points in a program, or if the course was not specified.

The sample size category was established to ensure generalizability of outcomes. Articles received a score of five points for a sample size great than 100 participants; four points for 75-100 participants; three points for 50-74 participants; two points for 25-49 participants; and one point if there were less than twenty-five participants. There were no automatic exclusion criteria for this category.

In order to eliminate sampling bias and strengthen external validity the Randomization category was developed. Articles received two points if random sampling was used, and one point if convenience sampling was used. There were no automatic exclusion criteria for this category.

The Evaluation Method category was designed to establish the best evidence supporting the learning outcomes of utilizing high fidelity simulation as pedagogy. Articles achieved three points if three or more objective evaluation methods were used (i.e., pre-test, post-test, GPA, clinical performance, course grade, checklists, judgment rubric); two points if two objective evaluation methods were used; one point if only one objective evaluation method was used. Articles were automatically excluded if the only objective evaluation used was: self-confidence, perceived confidence, Simulation Evaluation Tool, or Self-efficacy Survey.

To establish consistency of observation the Interobserver Reliability category was created. Articles were assigned three points for interobserver reliability coefficient > .90; two points for interobserver reliability coefficient .70-.90; 1 point for interobserver reliability coefficient < .70; zero points if interobserver reliability was not mentioned.

The development of the Internal Consistency Reliability category was used to determine the consistency of an evaluation tool. Articles were given a score of three points for Cronbach's alpha, or Spearman Brown Coefficient > .90; two points for Cronbach's alpha, or Spearman Brown Coefficient .70-.90; one point for Cronbach's alpha or Spearman Brown Coefficient < .70 or a mention of established internal consistency without supporting data; zero points if internal consistency was left unmentioned.

The Content Validity category was established to determine if items within the simulation or evaluation tools were related to learning objectives and outcomes. Articles received two points if content validity was addressed, and one point if validity was not addressed. There was no exclusion criterion for this category.

The validation of the scoring key was guided by nursing professionals. Their feedback assisted with the allocation of points to each category. Moreover, they assisted in clarifying exclusion criteria to ascertain articles that were specifically pertinent to the stated research questions.

A single multi-database search was conducted within CINAHL Complete, PsycINFO, and Health Source: Nursing/Academic Edition. The terms used in the search were: manikins or "models, anatomic", or mannequins or "high fidelity" or "simulation lab" or "sim lab" and curric* and nursing. The following limiters were applied: published date between 2000 and 2016, and peer reviewed. This publication date range was selected because the adoption of high fidelity simulation in nursing education began around this time. Special limiters applied to each database were: English language to CINAHL and PsycINFO, as Health Source Nursing Academic Edition did not specifically allow for language selection. One hundred seventy-two articles were initially retrieved. Preliminary analysis of individual abstracts was conducted using the automatic exclusion criteria of a scoring key. Of the initial 172 articles, 30 articles were selected for further review using the scoring key, resulting in the inclusion of nine articles.

As a result of the low yield of inclusion articles in the multi-database search, an additional search was conducted using ProQuest Nursing and Allied Health Source. The keywords entered into the database were: manikins or “models, anatomic”, or mannequins or “high fidelity” or “simulation lab” or “sim lab” and curric* and nursing. Nine hundred seventy-six articles were initially retrieved, with a final yield of 948 articles, correcting for duplicates. The related abstracts were reviewed using the automatic exclusion criteria of the scoring key. A total of twenty-two articles were further evaluated using the scoring key, resulting in the inclusion of an additional seven articles.

Final analysis of collected articles using the scoring key revealed a total score range of ten to seventeen out of a possible twenty-five points. Of the sixteen articles evaluated using the scoring key, fifteen articles satisfied the minimum score requirement. The scores for each article included in the literature review are summarized in Table 1.

Table 1. Summary of Evaluative Scoring

Article	Article Focus	Sample Demographics	Stage in Program	Sample Size	Randomization	Evaluation Method	Interobserver Reliability	Internal Consistency/ Reliability	Content Validity	Total
Aqel & Ahmad, 2014	2	2	3	4	1	2	0	0	1	15
Brannan, White, & Bezanson, 2008	1	2	3	5	1	1	0	2	2	17
Coffman, Doolen & Llasus, 2014	2	2	3	2	1	1	3	0	2	16
Elfrink,	1	1	1	4	1	2	0	0	1	11

Kirkpatrick, Nininger, & Schubert, 2010										
Gates, Parr, & Hughen, 2012	1	2	3	5	1	2	0	0	1	15
Grady, et al., 2008	1	1	3	2	1	2	3	3	1	17
Harris, 2011	1	2	2	3	1	2	0	0	1	12
Hart, et al., 2014	2	2	2	2	1	2	0	0	1	12
Hooper, Shaw, & Zamzam, 2015	2	2	2	5	1	2	0	0	1	15
Liaw et al., 2010	1	2	1	3	1	1	0	0	2	11
Schlairet & Pollock, 2010	2	2	3	3	1	2	0	1	1	15
Shinnick & Woo, 2013	1	2	3	5	1	3	0	1	2	18
Simonelli & Paskausky, 2012	2	2	2	5	1	3	0	0	0	15
Smith & Barry, 2011	2	2	2	2	1	1	0	0	1	11
Wood & Toronto, 2012	1	2	1	4	1	1	0	3	1	14

Selected studies were initially categorized based on the learning outcomes of knowledge acquisition and retention, skills acquisition and retention, critical thinking, clinical judgment, and overall competence. Further organization of articles was based on whether or not integration of simulation was explored. Study findings were organized to determine the effect of high-fidelity simulation on the stated learning outcomes.

Overview of Simulation in Nursing Education

Simulation has been used as both a supplemental teaching strategy, and in lieu of traditional pedagogical methods, such as lecture, lab, and clinical. The fidelity of the simulator selected has traditionally been determined by the objectives of the simulation scenario. Low fidelity simulators utilize task trainers to teach psychomotor skills (Nehring & Lashley, 2010). Instructors use moderate fidelity simulators to provide instruction on basic human biological actions, such pulses, and breathing (Nehring & Lashley, 2010). High fidelity simulators allow for the programming of specific health conditions and responses to nursing interventions (Nehring & Lashley, 2010). A recent survey conducted by the National College State Boards of Nursing revealed that 87% of prelicensure nursing programs utilized some form of medium to high-fidelity simulation, most often as part of a foundational nursing course (Hayden, 2010) Moreover, faculty reported that simulation was often used to teach clinical decision-making and psychomotor skills (Hayden, 2010). With the consistent increase in use of simulation in nursing programs, simulation educators are currently focused on effective integration of simulation into nursing curricula. More specifically, these instructors are reviewing the influence of the amount and fidelity of simulations on student learning outcomes.

Knowledge Acquisition and Retention

Researcher is ongoing regarding the impact of simulation on the learning outcomes of knowledge acquisition and retention. The literature has measured these outcomes by comparing simulation fidelity, such as the use of high vs. low-fidelity simulation (Aqel &Ahmad, 2014). Moreover, studies have paralleled knowledge acquisition between high-fidelity simulation and traditional teaching methods, such as lecture and clinical (Brannon, White, & Bezanson, 2008; Schlairet & Pollock, 2010). The results have been mixed, as Brannon, White, and Bezanson (2008) found that simulation participants demonstrated a superior performance in post-test knowledge when compared to traditional teaching. However, Schlairet and Pollock (2010) found that the two instructional methods had statistically equivalent performances on a knowledge test.

Skills Acquisition and Retention

The research regarding the effects of simulation on acquiring and retaining skills generally compares outcomes using various simulation fidelities. Analogous to knowledge acquisition, skills outcomes are most often compared between high and low-fidelity simulation (Aqel & Ahmad, 2014; Grady et al., 2008). Grady et al. (2008) reported higher skills performance in participants that received high-fidelity simulation in comparison to low-fidelity. More recent studies have concentrated on the timespan skills are retained when using high-fidelity simulation (Aqel & Ahmad, 2014; Hart et al., 2014).The findings of these studies provided mixed evidence on the use of simulation improving skills retention. Aqel and Ahmad (2014) found that initially both the high fidelity and low fidelity simulation groups demonstrated improved skills, however both groups demonstrated a decline in retention after three months. Conversely, Hart et al. (2014) found that simulation participants showed improvements in their skills over time.

Critical Thinking

The literature has not evaluated critical thinking directly in the context of simulation scenarios. Instead, students' critical thinking skills are often evaluated indirectly by standardized multiple-choice examinations taken in the classroom, such as the Health Sciences Reasoning, California Critical Thinking Disposition Inventory, and RN Nursing Care of Children Content Mastery Tests (Harris, 2011; Shinnick &Woo, 2013; Wood & Toronto, 2012). Studies generally compare the influence of high-fidelity simulation vs. traditional teaching methods on enhancing critical thinking (Harris, 2011; Wood & Toronto, 2012). Research findings for this learning domain also provide mixed evidence. Harris (2011) found that participants in the simulation group had significantly higher clinical grades reflective of critical thinking ability than traditional instruction. However, Wood and Toronto (2012) found no significant difference between simulation and traditional instructional groups on critical thinking. Research is currently shifting towards identifying predictors of critical thinking (Shinnick & Woo, 2013). Suspected covariates that influence critical thinking, such as age, previous simulation experience, learning style, self-efficacy, and baseline knowledge have been evaluated to determine their effectiveness in predicting critical thinking ability. Shinnick and Woo (2013) found that only age, baseline knowledge, and self-efficacy accurately predict critical thinking.

Clinical Judgment

The effects of high-fidelity simulation on the development of clinical judgment have been explored both in the context of simulation as well as performance in the clinical setting. Measurement of clinical judgment within the scenario is often done using researcher-developed checklists (Liaw et al., 2010). One such example of this evaluation method was the use of a checklist to evaluate clinical judgment over the course of two scenarios. Liaw et al. (2011) found significantly higher clinical judgment in the simulation group when compared with traditional instruction. Other studies have attributed attention to the how clinical judgment translates from high-fidelity simulation scenarios into the clinical setting (Harris, 2011). Harris (2011) found that participants in a simulation orientation demonstrated significantly higher clinical judgment in the clinical setting in comparison to the traditional instruction group.

Student Perceptions

Learner perceptions of simulation in reference to student satisfaction and perceived self-confidence, has consistently been explored in the literature. Much of the literature focuses on the evaluation of students' self-confidence and satisfaction as positive outcomes of high-fidelity simulation (Brannon, White, & Bezanson, 2008; Smith & Barry, 2011). Brannon, White, and

Bezanson (2008) found that confidence was not significantly higher for participants that received high-fidelity simulation in comparison to those that were exposed to traditional teaching methods. Conversely, Smith and Barry (2011) high levels of satisfaction and self-confidence in participants exposed to high-fidelity simulation. Current research is focused on determining if a correlation exists between design characteristics, such as fidelity, simulation objectives, and problem-solving within the scenario and self-confidence (Smith & Barry, 2011).

Curriculum Integration

Curriculum integration of high fidelity simulation is a relatively newer focus in the literature. The appropriate sequence and dosing of simulation as identified in the research is still in its infancy. Some studies observe outcomes based on strategically integrated high- fidelity simulation throughout a course (Hart et al., 2014). Other literature is focused on demonstrating that designing scenarios to match course content can improve learning outcomes (Coffman, Doolen, & Llasus, 2015). More research on the integration of simulation into nursing courses across the curriculum should be forthcoming as nursing programs continue to adopt and expand their simulation programs.

High-Fidelity Simulation Interventions

All fifteen research articles involved the evaluation of high-fidelity simulation as an intervention. Six studies used high-fidelity simulation in various frequencies ranging from one to six scenarios as the primary intervention (Elfrink, Kirkpatrick, Nininger, & Schubert, 2010; Gates, Parr, & Hughen, 2012; Hooper, Shaw, & Zamzam, 2015; Smith & Barry, 2011; Shinnick & Woo, 2012; Simonelli & Paskausky, 2012). Five studies compared the use of high-fidelity simulation with traditional teaching strategies, such as lecture, problem-based learning, and clinical (Brannan, White, & Bezanson, 2008; Harris, 2011; Liaw et al., 2010; Schlairet &

Pollock, 2010; Wood & Toronto, 2012). However, the interventions varied in terms of delivery and length of exposure. Two studies involved a comparison of high and low fidelity simulation (Aqel & Ahmad, 2014; Grady et al., 2008). Two studies evaluated high fidelity simulation as part of a curricular integration intervention (Coffman,et al., 2015; Hart et al., 2014).

Measures Used for Learning Outcomes

Knowledge acquisition and retention were commonly evaluated using researcher developed NCLEX style multiple-choice exams (Aqel & Ahmad, 2014; Elfrink, Kirkpatrick, Nininger, & Schubert, 2010; Gates, Parr, & Hughen, 2012; Hooper, Shaw, & Zamzam, 2015; Smith & Barry, 2011; Simonelli & Paskausky, 2012). Reliability for many of the tests is unknown, however two studies established reliability coefficients ≥ .74 in measuring tools (Brannon, White, & Bezanson, 2008; Schlairet & Pollock, 2010). One study utilized a standardized Assessment Technologies Institute Care of Children Content Mastery Test (Harris, 2011).

Skills acquisition was often evaluated alongside knowledge using the same measure. A performance rubric with established interobserver reliability of 100% was used in one study (Coffman et al., 2015). Clinical performance grade was used in another study (Simonelli & Paskausky, 2012). Independent evaluation of skills acquisition was done using checklists (Aqel & Ahmad, 2014). One study established reliability in checklists as a measure with reliability coefficient ≥ .84 (Grady et al., 2008).

Critical thinking was measured using various instruments. One study utilized the established reliable measure Health Science Reasoning Test (HSRT) (Shinnick & Woo, 2013). The HSRT is a 33 item multiple-choice exam with scores above twenty-four indicating very strong critical thinking ability (Shinnick & Woo, 2013). Clinical performance grade was utilized in another study to evaluate how critical thinking translated from simulation into the clinical setting (Harris, 2011). The California Critical Thinking Disposition Inventory was used in one study, with established reliability of Cronbach's alpha = .91 (Wood & Toronto, 2012). This tool evaluates a learner's critical thinking skills in seven domains: "truth-seeking, open-mindedness, analyticity, systematicity, critical thinking, self-confidence, inquisitiveness, and judiciousness or maturity of judgment" (Wood & Toronto, 2012, p.350).

Performance analogous to clinical judgment was measured using a variety of instrumentation. The lowest level of measurement used was the checklist (Liaw et al., 2010). The modified Emergency Response Performance (ERPT) and Patient Outcome Tools were used in one study (Hart et al., 2014). The ERPT is a two-part instrument consisting twelve-item section that evaluates the completion of basic life support interventions, and a timeline of intervention initiation (Hart et al., 2014). The Patient Outcome Tool measured the elapsed time to implement cardiopulmonary resuscitation (Hart et al., 2014).

Students' perceptions were often measured in reference to self-confidence, satisfaction, and efficacy of the simulation. One study utilized the Student Satisfaction and Self-Confidence in Learning Scale and the Simulation Design Scale (Smith & Barry, 2011). The National League of Nursing (NLN) developed both instruments (Smith & Barry, 2011). The Self-Confidence in Learning Scale and the Simulation Design Scale uses a 5-point Likert Scale to evaluate perceived confidence and satisfaction of participants (Smith & Barry, 2011). The Simulation Design Scale asks for participant perceptions on the inclusion of simulation design characteristics: "objectives, support, problem-solving, feedback, and fidelity" (Smith & Barry, 2011, p.302). A final study used the 34-item Confidence Level Tool graded on a Likert scale, which consisted of four subcategories related to the nursing process (Brannan, White, & Bezanson, 2008).

Curriculum integration of high fidelity simulation was only measured directly by one research study. Coffman et al. (2015) used two researcher-developed questionnaires to gain insight into faculty and student perceptions regarding curricular integration of simulation. Additionally, a performance rubric was used to measure learning outcomes as cited by the simulation program objectives (Coffman et al., 2015). Smith and Barry (2011) used the NLN Simulation Design Scale to determine student perceptions of how objectives were met. Hart et al. (2014) focused on measuring learning outcomes with the Emergency Response Performance and Patient Outcome Performance tool to demonstrate curriculum integration of high fidelity simulation. Hooper, Shaw, and Zamzam (2015) measured curriculum integration of large simulations by measuring knowledge as an outcome with a quiz.

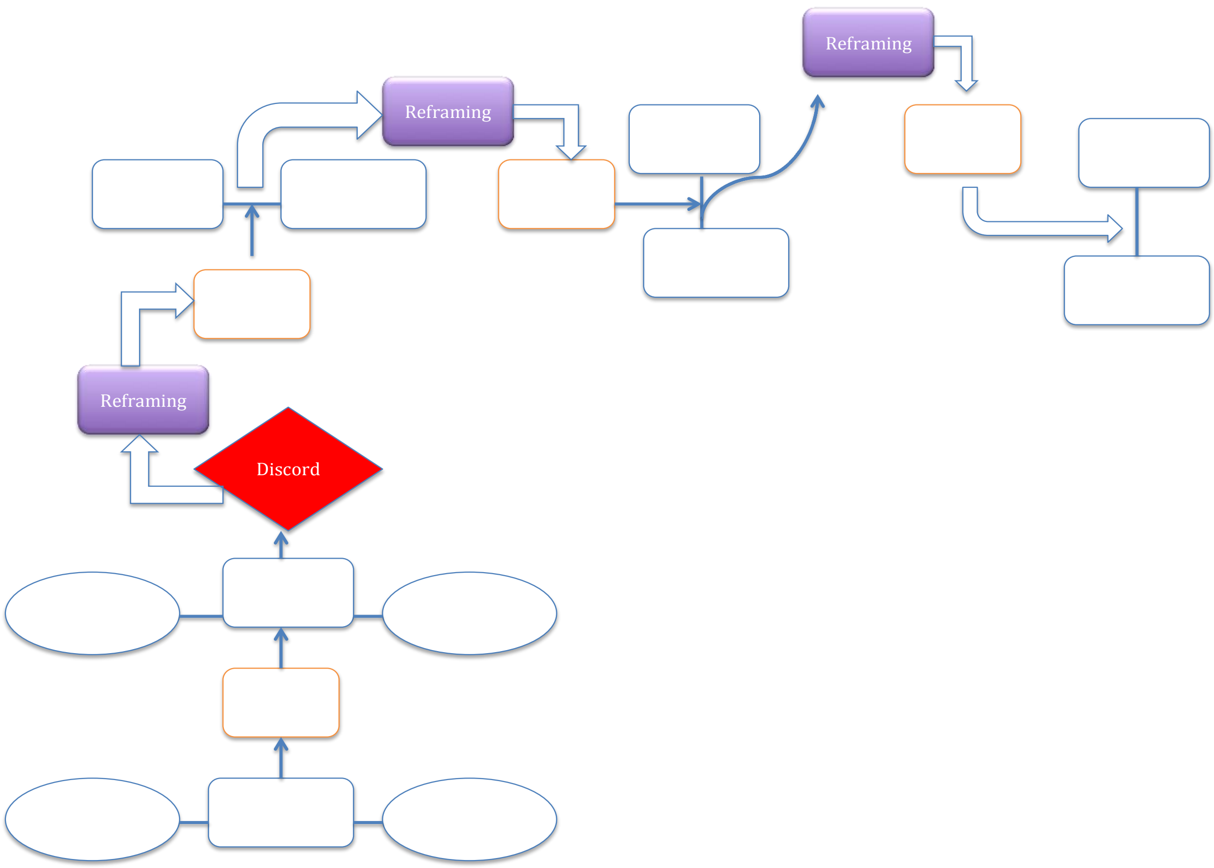
In summary, the evidence provided in this extensive review provides substantial support that high fidelity simulation yields positive learning outcomes in nursing education (see Appendix A). Moreover, it presents creative ways to integrate simulation into nursing curricula as a supportive pedagogy to enhance knowledge, skills, critical thinking, and clinical judgment as components of clinical competence. Further research efforts must focus on establishing reliable learning outcome measures for high fidelity simulation, and identifying the appropriate amount and sequence of simulation in nursing curricula.

Theoretical Framework

The theoretical framework for this study was developed from the work of Kolb and Mezirow. Kolb's experiential learning theory declares that knowledge is acquired by transforming experience. The four stages of the learning cycle include: concrete experience, reflective observation, abstract conceptualization, and active experimentation (Sternberg & Zhang, 2001). The concrete experience stage provides learning through a direct hands-on experience (Sternberg & Zhang, 2001). The learner then reflects and assimilates components of the experience during the reflective observation stage to form abstract concepts (Sternberg & Zhang, 2001). These abstract concepts guide behavior in the active experimentation stage (Sternberg & Zhang, 2001).

The transformative learning theory asserts that the foundation of learning consists of two-part meaning structures, or frames of reference (Mezirow, 1994). The first component of meaning structures is a meaning perspective, or “broad sets of predispositions resulting from psychocultural assumptions which determine the horizons of our expectations” (Mezirow, 1994, p.223). Meaning schemes make up the other element of meaning structures. Mezirow (1994) describes meaning schemes as “the constellation of concept, belief, judgment, and feeling which shape a particular interpretation” (p.223). Mezirow (1994) argues that learners are resistant to learning new information that is inconsistent with their meaning structures. When a new experience challenges the current meaning structure, learning occurs by expanding or developing a new meaning scheme, or transforming an existing meaning scheme or perspective (Mezirow, 2009, p.22).

Figure 1. Competence Model



Legend: This figure illustrates the process of developing clinical competence. The initial schema is transformed to a refined schema through the process of reframing with each additional simulation experience. The refined schema is then applied in the clinical setting where final reframing occurs to reflect competence.

The development of clinical competence is a transformative learning process that integrates knowledge and experience through reframing. This process is accomplished by the combined use of lecture, lab, simulation, and clinical experiences. Each simulation experience provides the learner with an opportunity to reframe and strengthen the current schema. The process begins with the preliminary integration stage, where theoretical knowledge obtained through readings and lecture is combined with technical skills performed in a video to form a schema.

During the first simulation experience, the learner is presented with tasks and new information that cause discord in the current schema. The challenge to perceived theoretical knowledge acquired or the ability to complete skills with a basic level of clinical judgment and critical thinking may be the source of the internal conflict. This causes the learner to revise the current schema through critical reflection and the incorporation of newly acquired information during the debriefing component of the simulation. This process is referred to as reframing. Once the revised schema is formed, the learner is ready to proceed to the next phase.

The presentation of a repeated simulation will occur during the organized performance stage. The case scenario will introduce a similar level of critical thinking and clinical judgment, thus challenging the revised schema. Ideally, the learner's performance at this stage should demonstrate improvement through repeated exposure to the same simulation experience. The learner will further reframe the schema to incorporate information related to knowledge, skills, critical-thinking, and clinical judgment during the debriefing process.

The resulting schema is used during the refined performance stage. During this phase, the learner is presented with a more complex simulation case. The scenario will involve synthesizing knowledge and skills, and applying them appropriately to complete interventions using enhanced critical thinking and clinical judgment. The learner should respond more efficiently to the events that occur in the simulation case. This is the final opportunity for the learner to reframe the schema prior to a clinical experience.

The learner will then take the refined schema into the clinical setting. This will provide an opportunity to apply all knowledge and behaviors associated with the schema on an assigned patient. Final challenges to the schema will occur at this point, as the human patient presents new challenges that simulation cannot always replicate. At the completion of the stage the schema will be polished and reflect competence.

Chapter 3. Methods

Research Design

A two-group time series experimental design was used to evaluate the impact of high fidelity simulation on improving clinical competence. This design was selected for the benefit of tracking the effect of the intervention over time. The independent variables were instructional method (i.e., traditional lab versus high fidelity simulation) and time (pre intervention, post intervention, and three weeks post intervention). The dependent variables in this study were: knowledge, skills, critical thinking, and clinical judgment.

Sample

A convenience sample of first-year students enrolled in the winter 2017 quarter course offering of NSG 301: Introduction to the Art & Science of Nursing on the Lincoln Park Campus of DePaul University's second-degree generalist masters of Science in nursing program were recruited for this study. As part of the requirements for this course students must complete six 4-hour lab sessions during the first 6 weeks of the course. Therefore, students were divided into 1 of 6 lab groups based on the lab section they self-enrolled. The intervention group consisted of participants from 3 clinical groups, while the control group consisted of participants from the 3 other clinical groups.

Participant Recruitment

A total of 31 participants were recruited on the first day of class for the quarter. The principal investigator presented the study during an information session held at the end of lecture by reading an oral recruitment script and answering any questions potential participants had (see

Appendix B). The principal investigator then left the room, and a research collaborator answered final questions and collected consent forms from study participants.

Inclusion/ Exclusion Criteria

To be eligible for participation in the study participants had to be 18 years or older and first-year nursing students enrolled in the winter 2017 quarter offering of NSG 301: Introduction to the Art & Science of Nursing course on the Lincoln Park campus of DePaul University. All participants enrolled in the course were recruited regardless of gender, racial, or ethnic status.

As this was a single site study, students that were 18 years or older and first- year nursing students enrolled in the winter 2017 quarter offering of NSG 301: Introduction to the Art & Science of Nursing course on the Rosalind Franklin campus of DePaul University's School of Nursing Program were excluded. All other nursing students that were not currently enrolled in NSG 301 on either campus were also excluded from participation in this study. Additionally, participants that were not fluent or literate in English were excluded.

Random Assignment

Each lab section of participants was randomly assigned to the control or intervention groups using the RANDBETWEEN function in excel. There were three lab sections assigned to the control group: 1L3, 1L4, 1L5, and three lab sections assigned to the intervention group: 1L1, 1L2, and 1L6. The DePaul University School of Nursing MENP program provided a letter of support for random assignment of lab sections to the control or intervention group.

A research collaborator assigned each participant a unique identification number using the RAND function in excel. The unique identification numbers were emailed to participants individually using an email script prior to the first day of data collection. Participants were instructed that this number was to be used on all data collection forms utilized throughout the study.

Setting

This study was conducted in the DePaul University Interprofessional Simulation Lab. The lab consisted of a four-room simulation bay, with a centralized room for prebriefing, debriefing, and skills activities to take place. The medical-surgical room that was utilized in this study was a replica of a traditional single-patient hospital room. Emergency equipment, oxygenation, and suction devices were readily available, in addition to a bedside table. All simulation activities were conducted using the Laerdal Sim Man 3G manikin.

High-Fidelity Simulation Intervention

Scenario Development. Three high fidelity simulation scenarios were developed by modifying existing evidence-based scenarios to reflect a foundational perspective of caring for a medical–surgical patient in an acute care setting. All scenarios required the participants to perform a head-to-toe physical assessment, administer a medication via the intramuscular route, and insert a nasogastric tube. The simulation cases were designed to match the following course objectives of the Nursing Fundamentals Course:

1. Demonstrate use of nursing science and the nursing process in the performance and documentation of clinical skills and preventions that are safe, effective, and relevant to patient care.
2. Demonstrate personal accountability, critical thinking and integration of the art of nursing in the performance of nursing skills within a beginning model of professional practice.

3. Demonstrate the use of nursing knowledge specific to the care of older adults in acute, intermediate, and skilled care settings.
4. Contrast therapeutic and social communication, and demonstrate beginning therapeutic communication skills.

The scenarios also met one of DePaul University's Master's of Entry into Nursing Practice program objectives: Contribute to excellence in patient care and advances in nursing knowledge across the lifespan through advanced health assessment, evidence-based professional practice, systematic inquiry, planned innovation, and dissemination of information to consumer and professional audiences (DePaul University, 2001).

Case Scenarios

Baseline and repeat scenario. The simulation case used for the baseline and repeated scenario involved preoperative nursing interventions for a patient scheduled to have a cholecystectomy. The patient was a 67-year-old male that presented with abdominal pain, nausea, and vomiting as result of cholelithiasis and cholecystitis (see Appendix C). Participants were required to perform a physical assessment on the patient, and note abnormal findings. Participants then needed to communicate with the healthcare provider regarding the conflict between the medication orders and the patient's allergies. Once orders are clarified, participants administered an intramuscular medication, and inserted a nasogastric tube.

Intervention group instructional scenario. The instructional simulation case for the intervention group consisted of participants providing care to a patient with a small bowel obstruction. The patient was a 61-year-old male admitted with a periumbilical pain, nausea, and diarrhea over the previous 3 days (see Appendix D). The patient was admitted during change of shift. Participants had to complete the initial assessment of the patient and contact the provider for orders. The scenario similarly required the administration of an intramuscular medication, and insertion of a nasogastric tube.

Advanced level scenario for both groups. The final case that both the control and intervention groups completed was providing care for a patient with a postoperative ileus. The patient was a 72-year-old female that was two days status-post an uncomplicated laparoscopic cholecystectomy (see Appendix E). The patient was complaining of abdominal fullness and pain, along with nausea and vomiting. Participants needed to complete a physical assessment and notify the provider of abnormal findings. Upon verification of provider orders, participants administered intramuscular medication and inserted a nasogastric tube.

Measurements

A demographic data sheet was used to identify potential variance between the control and intervention groups. The demographic data sheet was a paper and pencil form that consisted of fill in the blank questions. The questions ascertained the following data: age, gender, grade point average, and prior healthcare experience (see Appendix F).

Knowledge acquisition and retention were evaluated using a fifteen item multiple-choice paper and pencil quiz developed by the principal investigator (see Appendix G). The quiz was reflective of content presented during the online lecturette, skills video, and simulation experience. There were three sections of the quiz that corresponded to content related to the three skills included in each scenario: Head-to-toe assessment, medication administration, and nasogastric tubes. Each section contained five questions. The quiz was circulated to the principal investigator's research committee to verify content validity. To establish test-retest reliability of the 15-question quiz, eleven volunteer participants were given the quiz prior to beginning the simulation, and again after the simulation on the day of pilot testing. The question and answer order were randomized for all versions of the quiz to prevent recall bias.

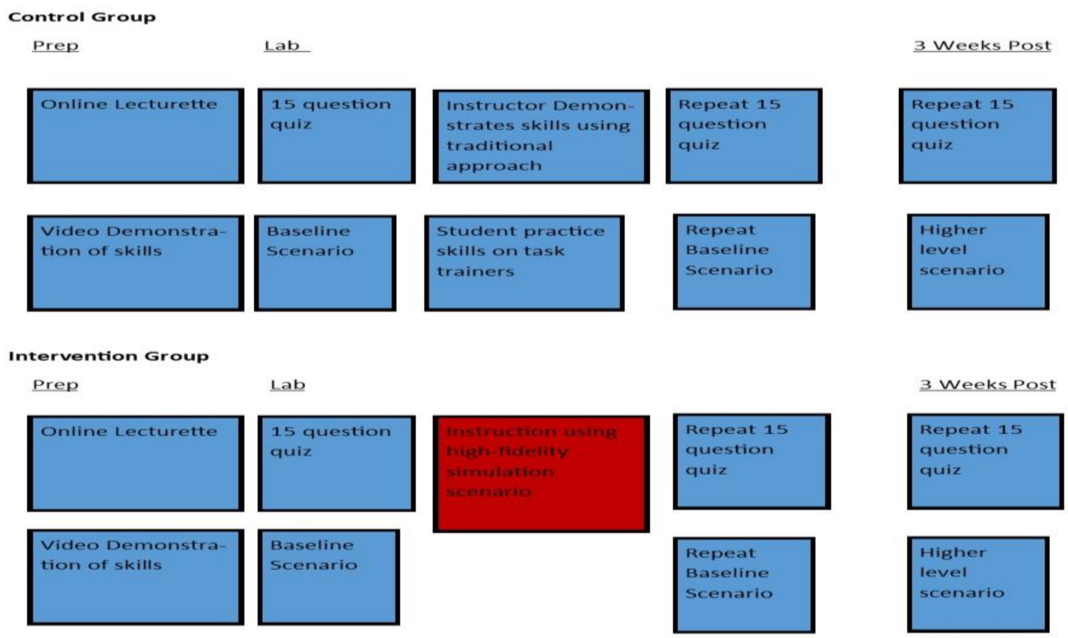
Clinical judgment was measured using the Lasater Clinical Judgment Rubric with permission. This tool was developed using the framework of Tanner's Clinical Judgment Model, which outlines the stages of clinical judgment development (Lasater, 2007) (see Appendix H). The four phases of clinical judgment included in this rubric were: noticing, interpreting, responding, and reflecting. Noticing involves observation, recognition of deviations, and information seeking dimensions. The interpreting phase encompasses the dimensions of prioritization and interpretation of data. Responding incorporates the dimensions of confident mannerisms, communication, intervention planning, and skillfulness. The final phase of reflecting includes the dimensions of self-evaluation and improvement plan. All dimensions are scored as exemplary, accomplished, developing, or beginning according to established criteria. The maximum score that could be achieved in this rubric is 44, which indicated exemplary in all dimensions (Lasater, 2007). Internal consistency for this tool is high with Cronbach's alpha = .974 (Adamson & Kardong-Edgren, 2012). To establish interobserver reliability for the Lasater Clinical Judgment Rubric, the scenarios were recorded and scored by the principal investigator and research collaborator on the day of pilot testing.

Critical thinking, skills acquisition and retention were measured by the use of the Creighton Competency Evaluation Instrument (C-CEI) with permission (Hayden, Keegan, Kardong-Edgren, & Smiley, 2014) (see Appendix I). The C-CEI had a total of 4 categories: assessment, communication, clinical judgment, and patient safety. This tool was revised by the National College State Boards of Nursing from the original version of the Creighton Simulation Evaluation Inventory (C-SEI) developed in 2008. The revisions of the tool were done to incorporate Quality and Safety Education in Nursing (QSEN) language along with amendments to the AACN Essentials (Hayden, Keegan, Kardong-Edgren, & Smiley, 2014). Modifications to the C-SEI included changes in terminology of two broad categories contained within the tool: critical thinking and specific skills. Critical thinking was renamed clinical judgment to reflect the summation of experiences that build critical thinking, problem solving, and clinical reasoning skills (Hayden et al., 2014). Patient Safety is the title used to replace the Specific Skills category. One additional evaluation subcategory was added to each of these two sections. The interrater reliability for the C-CEI is 79.4%, with Cronbach's alpha greater than .90 to reflect high internal consistency (Hayden et al., 2014). To establish interobserver reliability for this evaluation tool, the scenarios were recorded and scored by the principal investigator and research collaborator on the day of pilot testing.

Data Collection Procedure

The control and intervention groups were required to prepare for the baseline scenario during the first week of the Nursing Fundamentals course (see Figure 2).

Figure 2. Study Activities



Legend: This figure illustrates the learning activities that the control group (traditional instruction) and the intervention group (simulation instruction) will participate in as part of the study.

The preparatory assignments were developed by the study's principal investigator, and consisted of watching an online lecturette and video demonstration of the required skills. Both assignments were uploaded into the university online learning management system. Additionally, a brief version of scenarios with objectives was uploaded for the students to review (see Appendix J). The lecturette was a PowerPoint presentation with a voiceover that reviewed the following:

1. A bedside head-to-toe physical assessment with normal and abnormal findings
2. Medication administration verifying the five rights
3. Questioning medication orders
4. Uses for a nasogastric tube
5. Insertion of a nasogastric tube
6. Verification of nasogastric tube placement

7. SBAR Communication
8. GI illnesses (i.e., small bowel obstruction, cholecystitis)

The video provided visual instruction on how to complete the necessary skills to perform successfully during the simulation. The skills demonstrated by the principal investigator in the video were performed using a Laerdal 3G manikin. The following skills were reviewed:

1. Bedside head-to-toe physical assessment
2. Medication administration verifying the 5 rights
3. Insertion of a nasogastric tube
4. Verification of nasogastric tube placement
5. SBAR Communication

In addition to completing the required preparatory work, participants received an orientation to the simulation lab during their scheduled lab of the first week of the quarter. The principal investigator utilized a structured orientation checklist to ensure consistency among each group (see Appendix K). The entire lab group of study participants was brought into the simulation room at once. The room was set up to mimic the visual structure that was used for all simulations in this study. Participants were oriented to the location of the oxygen and suction wall supply, emergency equipment, medications, and nasogastric tube supplies. Participants also received instruction on how to operate the wall suction. The manikin was turned on so that the principal investigator could provide instruction on the location for auscultating heart, lung, and bowel, sounds, palpating peripheral pulses, and the correct placement of the blood pressure cuff and thermometer. Participants were also shown the location of the patient’s ID band. Finally participants received 10 minutes to ask questions and practice with the manikin and equipment in the simulation room. The entire orientation took place over a 20 minute time period.

During the second week of the course, the principal investigator and research collaborator conducted all lab and simulation activities for the six lab groups to maintain internal consistency. Participants in each lab group were randomly divided into two sub-lab groups by having each participant draw a card that stated “group 1” or “group 2.” These groups remained the same for the duration of the study. The use of small groups ensured that participants would have the ability to actively participate in each scenario. There was a staggered schedule of activities so that each sub-lab group was allotted the same time to complete learning activities (see Appendix L).

Both control and intervention groups began the lab by completing a paper and pencil demographic data sheet. Participants placed the completed form in an envelope labeled with the lab section (1L__) and sub-lab group (1 or 2). Once all data sheets were collected, the fifteen-item multiple-choice knowledge quiz was administered. Participants were given fifteen minutes to complete the quiz. Once completed, participants placed the quiz in the designated envelope. The answers to the questions were not provided to the students at the conclusion of the quiz.

Upon completion of the quiz, subjects participated in a 5-minute prebriefing using a standardized guide developed by the principal investigator of this study (see Appendix M). The prebriefing began with a review of the patient’s medical history. Participants were informed of which component of patient care would be occurring at the start of the scenario. All objectives for the simulation were also discussed. Participants were then informed that there are no assigned roles for the scenario. The time to complete the scenario was the final component of the prebriefing. Participants were instructed that the scenario would end after 25 minutes, regardless of whether or not all scenario objectives had been met.

Participants then moved into the simulation bay to complete the baseline scenario. Debriefing occurred immediately following the scenario using a standardized debriefing guide that utilizes the Gather, Analyze, and Summarize (GAS) approach (see Appendix N). This method of debriefing was selected because it facilitates the development of clinical reasoning through reflective thinking. Moreover, it permitted facilitators to standardize the debriefing guide by developing reflective questions that compare the student learners' actual performance with expected actions to achieve scenario objectives. The debriefing period was limited to 25 minutes.

Following a brief 5-minute break after the debriefing, students completed either the traditional or simulation instruction method of practicing skills. Participants in the control group had 1 hour to complete learning activities, whereas intervention group participants had 55 minutes to compete the intervention simulation activities.

Traditional Instruction

This teaching method consisted of the principal investigator or research collaborator providing an in-person review of each skill. A demonstration of the head to toe physical assessment and nasogastric tube insertion was provided on a static manikin. Time was allotted for each student to practice these skills individually. The five rights of medication administration were also discussed, while demonstrating the process of withdrawing medication from a vial and reviewing injection sites on the manikin. Participants had an opportunity to aspirate medication from a vial and inject it into an injection pad.

Simulation Instruction

Participants practiced the essential skills of physical assessment, safe medication administration, and insertion of a nasogastric tube as part of the simulation experience. Participants had five minutes for prebriefing, 25 minutes to complete the scenario, and twenty-five minutes for debriefing. The standardized debriefing guide using the Gather, Analyze, and Summarize (GAS) method will be used to debrief this scenario. This provided an opportunity for the principal investigator and research collaborator to guide participants in self-reflection on performance and correct any deviations from the standard of practice in providing nursing care.

Upon the completion of their designated learning activities, participants repeated the fifteen-item multiple choice paper and pencil quiz. The quiz questions and order of answers were rearranged. Participants placed the completed quizzes in an envelope labeled with the lab section (1L__) and sub-lab group (1 or 2). Participants were then prebriefed for the repeated baseline scenario using the same guide. At the conclusion of the prebriefing, participants completed the scenario and debriefing. All testing and scenario activities remained consistant with the time frame of baseline data collection.

Three weeks after the initial scenario, participants returned for a final quiz and simulation case. The administered paper and pencil quiz was the same as the pre and post quiz, with a new question and answer order. Participants placed the completed quizzes in an envelope labeled with the lab section (1L__) and sub-lab group (1 or 2). Participants remained in the same groups they were in previously to complete the final scenario. The last scenario was more complex, requiring a higher level of critical thinking and incorporation of the same skills as all previous scenarios. Students were prebriefed using the standardized guide before proceeding through the scenario. The GAS method was used again to debrief students following the scenario. Once the final group had been debriefed the principal investigator provided the answer key with rationales for the quiz questions by email. All times for simulation activities remained consistent with baseline data collection.

Video Recording

To remain consistent with the facilitation standards of the DePaul University Interprofessional Simulation lab, participant performance in all scenarios were recorded using the Sim Capture platform. The Sim Capture platform was used to allow for password protected access and storage of recordings. Only the principal investigator and research collaborator had access to the video recordings. Each recorded scenario was filed with the label "Lab section (1L___), sub-lab group (1 or 2), and participant numbers" All recordings were retained until the study had been completed, at which point they were be deleted from the Sim Capture platform.

Data Analysis

Data were analyzed using Statistical Package for the Social Sciences (SPSS) 24. Descriptive statistics were used to evaluate the demographic data of the study sample. Data were assessed for normative distribution. A mixed factorial analysis of variance was conducted to test the effects of instructional method and time on the four learning outcomes: knowledge, skills, critical thinking, and clinical judgment. Post hoc comparisons of means for the main effect of time and simple effects of significant interactions were performed using Bonferroni adjustment.

Ethics and Human Subjects Protection

The study protocol was reviewed and approved by the DePaul University Institutional Review Board. All participants provided informed consent prior to the start of the study.

There was concern that participants may report feeling anxious providing patient care in the simulation lab while being video recorded. Video recordings of participant performance were maintained on the Sim Capture Platform. Access to this platform was password-protected, therefore only the principal investigator and research collaborator had access. Recordings were deleted once the study was complete.

Pilot Testing

Pilot testing of each scenario occurred prior to the implementation of this study. Eleven participants from the previous cohorts enrolled in NSG 301: The Art & Science of Nursing I were recruited to participate in the pilot testing of the three scenarios. Participants were given access to watch the lecturette one week prior to the day of pilot testing. All participants signed a consent form to be video recorded. Four students were randomly assigned to one of the three cases used in this study, with one scenario only having three participants. Participants began the day by taking the 15-item multiple-choice paper and pencil quiz. Participants were not given the answers upon completion of the quiz. Following the quiz, the principal investigator facilitated a scripted prebriefing prior to beginning the scenario. At the conclusion of the scenario, the participants took the quiz a second time with the questions and answers reordered to prevent recall bias. Once the final quiz was collected the principal investigator reviewed the answers to the quiz. The principal investigator then debriefed the students using the structured debriefing guide that followed the Gather, Analyze, and Summarize approach.

Results

Reliability Analysis

Evaluation of interobserver reliability was done for the Creighton Competency Evaluation Instrument (C-CEI) and the Lasater Clinical Judgment Rubric (LCJR) during pilot testing. The coefficient alpha (Cronbach 1951) is the measure used to reflect this interobserver reliability. The coefficient alpha for these tools were 1 and .89 for the C-CEI and LCJR, respectively.

Reliability of evaluation tools was also done during pilot testing, with the exception of the knowledge test. The reliability analysis of the knowledge test was omitted as a result of the small sample used for pilot testing. The coefficient alpha for the critical thinking and skills domains of the C-CEI was .56, The LCJR had a coefficient alpha of .86.

Sample Characteristics

A total of 31 participants initially enrolled in the study. Only 30 participants completed all three points of data collection. Based on the inclusion and exclusion criteria for the study one participant's data was excluded from analysis.

The majority of participants were female (90%). The age range for participants was between 22 and 46 years (M =26.9). Additionally, participants reported an average GPA of 3.7. Approximately 71% of participants reported having some previous healthcare experience (see Table 2).

Table 2. Characteristics of Study Participants (*n*=30)			
	Minimum	**Maximum**	**Mean**
Age	22	46	26.9
GPA	3	4	3.7
Gender	**Frequency**	**Percent**	**Cumulative Percent**
Female	27	90	90
Male	3	10	100
Healthcare Experience			
None	9	29	29
Less than 1 year	8	25.8	54.8
1-3 years	11	35.5	90.3
4-5 years	2	6.5	96.8
More than 5 years	1	3.2	100
Computerized Random Assignment	15 Control	50	50
	15 Intervention	50	100

Is there a difference in knowledge acquisition between student learners taught using high-fidelity simulation and those that receive the traditional instructional method?

A mixed factorial analysis of variance was conducted to assess the impact of two different instructional methods (Traditional, Simulation) on knowledge scores for a 15 question multiple-choice test across three time periods (pre intervention, post intervention, 3 weeks post intervention). There was a significant main effect of time on participant performance for the knowledge test, [F(2, 56) = 20.2, p < .001, η_p^2 = .42]. The main effect of time did not significantly violate the sphericity assumption (W = .92, X^2 (2) = 2.23, p = .33). The assumption of homogeneity of variance was not violated at pre intervention [F(1, 28) = .52, p = .48], post intervention [F(1,28) = .036, p = .85], and three weeks post intervention [F(1,28) = .05, p = .82].

Both groups showed an increase in knowledge over time (see Table 3). Post hoc analysis with Bonferroni correction revealed a significant difference in knowledge test scores between pre intervention and post intervention ($p < .001$), and pre intervention and three weeks post intervention ($p < .001$). However, there was no significant difference between post intervention and three weeks post intervention scores ($p = .24$). The main effect of instructional methods was not statistically significant [$F(1, 28) = .31$, $p = .58$, $\eta_p^2 = .01$], suggesting that there was no difference in the effectiveness of the two instructional approaches on scores for the knowledge test. Given the lack of significant interaction between instructional method and time [$F(2, 56) = .87$, $p = .42$, $\eta_p^2 = .03$], no further post hoc tests were performed.

Table 3. Comparison of Mean Knowledge Scores Between Groups Over Time

Instructional Method	**Pre Intervention** ***M (SD)***	**Post Intervention** ***M (SD)***	**3 Weeks Post Intervention** ***M (SD)***
Traditional	11.7 (1.71)	13.3 (1.35)	13.6 (.83)
Simulation	11.9 (1.60)	12.7 (1.39)	13.4 (.83)

Is there a difference in skills acquisition between student learners taught using high fidelity simulation and those that receive the traditional instructional method?

A mixed factorial analysis of variance was conducted to assess the impact of two different instructional methods (Traditional, Simulation) on skills scores using the Creighton Competency Evaluation Instrument across three time periods (pre intervention, post intervention, 3 weeks post intervention). The main effect of time on skills scores was significant [$F(1.19, 33.27) = 40.4$, $p < .001$, $\eta_p^2 = .59$]. Since the assumption of sphericity was violated ($W = .32$, $X^2(2) = 31.04$, $p < .001$), the Greenhouse-Geisser correction was used. The assumption of homogeneity of variance was not violated at pre intervention [$F(1, 28) = .085$, $p = .77$]. However, this assumption was violated at post intervention [$F(1, 28) = 12.03$, $p = .002$], and three weeks post intervention

[F(1,28) = 24.9, p < .001]. As a result of having an equal number of participants in each group, this violation was ignored. Table 4 illustrates the changes in skills among groups over time. Post hoc analysis with Bonferroni correction revealed a significant difference in participants' skills between pre intervention and post intervention (p < .001), and pre intervention and three weeks post intervention (p < .001). However, there was no significant difference between post intervention and three weeks post intervention scores (p = 1.00). The main effect of instructional methods was not statistically significant [F(1, 28) = 1.14, p = .30, η_p^2 = .04], suggesting that there was no difference in the effectiveness of the two instructional approaches on skills. The main interaction between instructional method and time was statistically not significant [F(1.19, 33.3) = .022, p = .92, η_p^2 = .001], therefore no further post hoc analysis was completed.

Table 4. Comparison of Mean Skills Scores Between Groups Over Time

Instructional Method	**Pre Intervention *M (SD)***	**Post Intervention *M (SD)***	**3 Weeks Post Intervention *M (SD)***
Traditional	4.40 (1.24)	5.87 (.35)	5.80 (.41)
Simulation	4.60 (1.18)	6 (.000)	6 (.000)

Is there a difference in critical thinking ability between student learners taught using high-fidelity simulation and those that receive the traditional instructional method?

A mixed factorial analysis of variance was conducted to assess the impact of two different instructional methods (Traditional, Simulation) on critical thinking scores using the Creighton Competency Evaluation Instrument across three time periods (pre intervention, post intervention, 3 weeks post intervention). The main effect of time on critical thinking scores was significant [F(2, 56) = 44.6, p < .001, η_p^2 = .61]. The assumption of sphericity was not violated [W = .84, X^2 (2) = 4.61, p = .100]. The assumption of homogeneity of variance was not violated at pre intervention [F(1, 28) = 3.84, p = .06]. However, this assumption was violated at post intervention [F(1, 28) = 12.03, p = .002], and three weeks post intervention [F(1, 28) = 14.9, p = .001]. This violation was ignored, as there were an equal number of participants in each group. The changes in critical thinking between the different instructional methods over time are shown in Table 5. Post hoc analysis with Bonferroni correction revealed differences in critical thinking from pre intervention to post intervention ($p < .001$), post intervention to three weeks post intervention ($p = .048$), and pre intervention to three weeks post intervention ($p < .001$). The main effect of instructional methods was not statistically significant [F(1, 28) = .37, p = .55, η_p^2 = .013], suggesting that there was no difference in the effectiveness of the two instructional approaches on critical thinking. There was a significant interaction between instructional method and time [F(2, 56) = 3.28, p = .045, η_p^2 = .11]. Post hoc analysis of this interaction revealed that there were significant changes in critical thinking for the traditional [F(2, 27) = 23.15, p <.001, η_p^2 = .63] and simulation groups [F(2, 27) = 22.14, p <.001, η_p^2 = .62]. However, there was only a significant difference between the two groups three weeks post intervention in favor of the simulation group [F(1, 28) = 4.22, p = .049, η_p^2 = .13].

Table 5. Comparison of Mean Critical Thinking Scores Between Groups Over Time

Instructional Method	**Pre Intervention** ***M (SD)***	**Post Intervention** ***M (SD)***	**3 Weeks Post Intervention** ***M (SD)***
Traditional	5.33 (.724)	7 (.000)	6.20 (1.21)
Simulation	5.13 (1.19)	6.87 (.35)	6.87 (.35)

Is there a difference in clinical judgment between student learners taught using high fidelity simulation and those that receive the traditional instructional method?

A mixed factorial analysis of variance was conducted to assess the impact of two different instructional methods (Traditional, Simulation) on clinical judgment scores using the Lasater Clinical Judgment Rubric across three time periods (pre intervention, post intervention, 3 weeks post intervention). The main effect of time on clinical judgment scores was significant [F(1.638, 45.862) = 42.7, $p < .001$ $\eta_p^2 = .60$]. The assumption of sphericity was violated [W = .78, $X^2(2) = 6.75$, p = .034], therefore the Greenhouse- Geisser correction was used. The assumption of homogeneity of variance was not violated at post intervention [F(1, 28) = .67, p = .42], and three weeks post intervention [F (1, 28) = 2.66, p = .11]. However, this assumption was violated at pre intervention [F (1, 28) = 12.6, p = .001]. Due to an equal number of participants in each group this violation was ignored. Table 6 highlights the differences in clinical judgment between instructional methods over time. Post hoc analysis with Bonferroni correction revealed differences in clinical judgment from pre intervention to post intervention ($p < .001$), and pre intervention to three weeks post intervention ($p < .001$). There is not statistically significant difference on clinical judgment scores between post intervention and three weeks post intervention (p = 1.00). The main effect of instructional methods was not statistically significant [F(1, 28) = .40, p = .53 $\eta_p^2 = .014$], suggesting that there was no difference in the effectiveness of the two instructional approaches on clinical judgment. Additionally, there was not a significant interaction between instructional method and time [F(1.64, 45.9) = .45, p = .60 $\eta_p^2 = .016$].

Table 6. Comparison of Mean Clinical Judgment Scores Between Groups Over Time

Instructional Method	**Pre Intervention** ***M (SD)***	**Post Intervention** ***M (SD)***	**3 Weeks Post Intervention** ***M (SD)***
Traditional	29.3 (2.79)	35.4 (1.24)	35.6 (5.30)
Simulation	28.1 (5.38)	34.6 (1.18)	35.9 (3.08)

Factor Analysis

As a result of utilizing a researcher developed knowledge test and piloting it with the study sample, a factor analysis was conducted to establish test reliability. The Kuder Richardson internal consistency reliability test is used on binary data, and is a specialized version of the

Cronbach's alpha test of reliability (Kuder & Richardson, 1937). Scores range from 0 to 1, with higher values indicating strong reliability. The knowledge test did not demonstrate consistent reliability with each administration of the exam. The internal consistency reliability coefficient (KR-20) showed an alpha of .35 pre intervention, .22 post intervention, and -.16 three weeks post intervention. Items with zero variance were dropped from analysis. As noted in Table 7, physical assessment question # 5 was dropped from analysis at all three points of test administration. Two of the four nasogastric tube items dropped from analysis three weeks post intervention were also dropped at the post intervention test.

Table 7. Factor Analysis Kuder-Richardson (KR-20)

Knowledge Test Question	**Pre Intervention KR-20 if Item Deleted**	**Post Intervention KR-20 if Item Deleted**	**3 Weeks Post Intervention KR-20 if Item Deleted**
Physical Assessment 1	.40	.16	-.73
Physical Assessment 2	.41	.36	-.31
Physical Assessment 3	.52	.36	-.28
Physical Assessment 4	.30	.33	-.28
Physical Assessment 5	Dropped from Analysis	Dropped from Analysis	Dropped from Analysis
Medication Administration 1	.21	.32	.06
Medication Administration 2	.39	.22	-.69
Medication Administration 3	.37	.19	Dropped from Analysis
Medication Administration 4	.26	.33	.08
Medication Administration 5	.39	.27	-.28
Nasogastric Tube 1	.38	Dropped from Analysis	Dropped from Analysis
Nasogastric Tube 2	.36	.29	Dropped from Analysis
Nasogastric Tube 3	.43	Dropped from Analysis	Dropped from Analysis

Nasogastric Tube 4	.42	.36	Dropped from Analysis
Nasogastric Tube 5	.39	.38	-.24

Discussion

The findings of this study are encouraging in that they contribute to the growing body of research that supports the use of high fidelity simulation on improving learning outcomes. Moreover, the significant improvements in knowledge, skills, critical thinking, and clinical judgment found in this study provide evidence that simulation is comparable to traditional teaching, and in some ways a more effective instructional method. The experiential learning offered through simulation allows student learners to synthesize theoretical information related to clinical conditions and apply it to various patient care scenarios (Brannon, White, Bezanson, 2008).

Knowledge Acquisition and Retention

The results of this study revealed that there was no significant difference in knowledge prior to the intervention. This finding supports the homogeneity of variance in knowledge during baseline data collection. Moreover, study results suggest that participants in both groups gained a fair amount of knowledge from watching the online lecturette prior to the intervention.

While there was consistent improvement in knowledge over time for both groups, participants in the traditional instructional group performed slightly higher on the knowledge test at both time points after the intervention. However, this difference in performance was not significant. These improvements in knowledge not only suggest that knowledge was acquired through both instructional methods, but that it was retained for a significant period of time thereafter. These findings are consistent with the literature, which demonstrates that high fidelity simulation increases knowledge acquisition (Brannon, White, Bezanson, 2008; Elfrink , Kirkpatrick, Nininger, & Schubert, 2010; Gates, Parr, & Hughen, 2012; Simonelli & Paskausky, 2012; Aqel & Ahmad, 2014).

Skills Acquisition and Retention

Study findings showed homogeneity of variance prior to the treatment for skills acquisition, indicating that baseline skill level was similar for each group. As supported in the literature (Grady et al., 2008; Simonelli & Paskausky, 2012; Aqel & Ahmad, 2014; Hart et al., 2014) the findings of this study revealed that high fidelity simulation enhanced skill acquisition. Both the traditional and simulation groups demonstrated advances in skill level from pre to post-intervention. Although the simulation group performed skills better than the traditional group post intervention, it was not statistically significant.

Skill performance varied slightly between the two groups three weeks post intervention. The traditional group demonstrated a small but insignificant decline in skill performance, while the simulation groups' skill performance remained unchanged achieving a perfect score at both time points post intervention. This finding suggests that both groups retained the skills acquired over time and were able to apply them appropriately to a different more complex scenario. This evidence is inconsistent with previous research that has demonstrated simulation does not positively impact skills retention (Aqel & Ahmad, 2014). Perhaps the length of time between post intervention and follow-up evaluation is a contributing factor in demonstrating skills retention in participants.

Critical Thinking

An interesting finding of this study was the influence of the interaction of instructional method and time on developing critical thinking skills. Both groups demonstrated homogeneity of variance at baseline, suggesting that participants in both groups had similar critical thinking ability initially. The traditional instruction group showed improvements in critical thinking pre to post intervention. However, there was a decline in critical thinking three weeks post intervention. Similarly, the simulation group demonstrated significant improvements from pre to post intervention, but critical thinking remained unchanged three weeks post intervention. These findings suggest that high fidelity simulation develops critical thinking better than traditional teaching methods.

Clinical Judgment

Study findings for clinical judgment prior to treatment demonstrated heterogeneity of variance, with the traditional group scoring higher. While both groups showed improvements in clinical judgment across time, the simulation group demonstrated better clinical judgment three weeks post intervention, though not significant. This finding suggests that both groups were able to appropriately apply clinical judgment skills gained to a more complicated clinical scenario. These results are supported in the literature, which has provided evidence that high fidelity improves clinical judgment skills in student learners (Liaw et al., 2010; Harris, 2011; Hart et al., 2014).

Factor Analysis

The factor analysis results showed poor reliability for the knowledge test at all three time points of data collection, with the strongest reliability pre intervention. It is apparent that even with 14 of the 15 items analyzed pre intervention, dropping the physical assessment question 3 would still not improve the reliability to an acceptable range. The lack of variance in physical assessment question 5 could indicate that student learners have mastered abdominal assessment skills. This is likely the result of having completed a physical assessment course prior to participating in this study. Another interesting finding is that more items were dropped from the knowledge test with each administration due to lack of variance. This was especially evident in the nasogastric tube subsection of the test. It is possible that there was no variance in the first four questions, as they relate to the process of inserting the nasogastric tube, which was discussed in the lecturette, and practiced on three separate occasions.

In addition to the reliability concerns of the knowledge test, these results also lend support to the need for further investigation on the utility of using multiple-choice tests to evaluate knowledge gained through experiential learning. While multiple-choice tests are consistently used in the literature to measure knowledge acquisition in simulation, there are clear limitations in their use. Multiple-choice tests primarily focus on evaluating the cognitive and psychomotor domains of learning, with minimal attention to the affective domain. For example, questions might assess recall of facts related to the use of nasogastric tubes and procedures for insertion, while ignoring the beliefs and attitudes that inform decision-making on their use. With the development of competence as the primary objective of simulation, evaluation must be inclusive of all domains of knowledge acquisition. This is especially important as the affective domain reflects a significant component of the knowledge gained during experiential learning activities.

The affective domain of learning places emphases on awareness and acceptance of beliefs and values that are congruent with evidence-based nursing practice (Oermann & Gaberson, 2014). Development of knowledge in this domain requires learners to transition from a state of awareness of the standards of practice, to internalizing them for use when they are faced with clinical decisions (Oermann & Gaberson, 2014). Using multiple-choice tests is not an appropriate method of evaluating this transition, as it does not allow instructors to evaluate consistent application of these standards while providing patient care over time (Oermann & Gaberson, 2014). This suggests that alternative methods of evaluating knowledge acquisition during simulation might be more reliable.

Structured reflection is an important form of evaluation that has been consistently used in the literature related to measurement in experiential learning. Students evaluate experiences through journals and portfolios. Reflection allows instructors to identify what students have learned during the learning experience by receiving detailed accounts of the connections made between theory and practice (Qualters, 2010). Moreover, it addresses the affective domain of learning by providing insight into the thoughts and feelings experienced by student learners while completing the scenario. While reflection gives a method of evaluating this domain of learning, there are concerns regarding the objective measurement of learning outcomes.

Astin (1993) proposed the I-E-O Model of evaluating acquired knowledge through reflection. I refers to input, meaning evaluating student learners' attitudes and perceptions prior to the learning experience through survey or reflection (Astin, 1993). E is environment, which requires instructors to evaluate learners during the experience through reflective journals and direct observation of performance in the clinical environment (Astin, 1993). Finally, O refers to output, which requires instructors to utilize the same evaluative tools used during the input stage to determine if learning took place. This model could easily be adopted by nursing faculty to provide a more comprehensive review of the learning that actually occurs during simulation.

Competence Model

The results of this study provide evidence to support the development of clinical competence using the conceptual model presented at the beginning of this study with some minor revisions (see Figure 3.). The process of developing clinical competence began with the

Preliminary Integration Stage. Student learners appeared to have baseline theoretical knowledge of conditions that warranted a nasogastric tube, and a basic sense of the steps of nasogastric tube insertion and medication administration from watching the online lecturette and video. This theoretical knowledge was used to form an initial schema that was used in the baseline scenario.

The baseline scenario required student learners to utilize the initial schema along with critical thinking and clinical judgment skills, which caused discord in the initial schema. This was apparent during the debriefing process, as student learners challenged events and procedures that occurred during the simulation that were inconsistent with their initial schema. The debriefing was used to provide an opportunity to reflect and clarify any inconsistencies so that the initial schema could be reframed into a reformed schema.

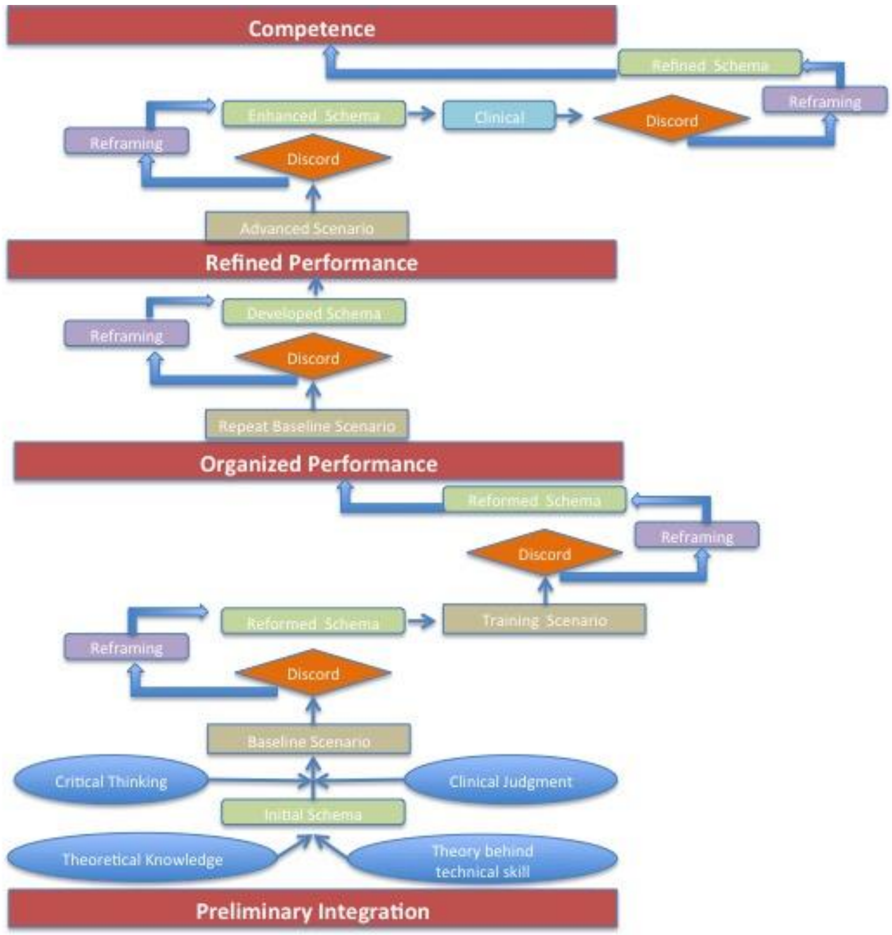
The reformed schema was utilized during the training scenario as the intervention for the simulation group. This scenario offered a similar GI scenario that required the same skills so that student learners could further integrate theoretical knowledge with skills while using critical thinking and clinical judgment. The intervention scenario caused discord again, which allowed the debriefing to be utilized to clarify inconsistencies in the reformed schema through reframing.

The reformed schema was carried into the Organized Performance Stage. Here, student learners were able to apply the reformed schema to the repeated baseline scenario. Performance in all learning domains showed significant improvement, resulting in only minor discord. The debriefing provided a final opportunity for student learners to reframe the knowledge, skills, critical thinking and clinical judgment as it applied to that clinical scenario resulting in a developed schema.

The developed schema remained intact for the three-week period as student learners moved into the Refined Performance Stage. At this point, they were presented with an advanced clinical scenario, which required similar knowledge and technical skill and a higher level of critical thinking and clinical judgment. Student learners responded more efficiently to the scenario with an improved knowledge base and retention of the technical skill. The student learners displayed evidence of a high level of critical thinking and enhanced clinical judgment skills. However, the scenario still caused some discord in the developed schema. The debriefing allowed student learners the final opportunity reframe the developed schema in the practice setting to form an enhanced schema.

The enhanced schema will be taken into the clinical setting where student learners will be presented with additional contextual information that will cause discord. The process of reframing will continue as student learners are presented with more information to assimilate. Ideally, the resultant refined schema will allow student learners to establish competence in providing caring for a patient with a GI disorder.

Figure 3.Revised Competence Model



Legend. This figure illustrates the process of developing clinical competence through the integration of knowledge, skills, critical thinking, and clinical judgment into a schema, which gets reframed over time through exposure to similar clinical scenarios using simulation. Ultimately, the enhanced schema is taken into the clinical setting where final reframing occurs to establish a refined schema and competence.

Limitations

While this study provides support for the use of high fidelity simulation on improving learning outcomes, there are several limitations that must be acknowledged. This study used a single site small convenience sample of participants enrolled in a nursing fundamentals course. This limits the generalizability of the study findings across nursing programs and to other courses in nursing curricula. Recruiting participants from different nursing programs enrolled in nursing fundamentals courses would have strengthened the generalizability of the findings.

A second limitation was the five-week duration of the study. During this time period the students received a lecture on the theoretical content related to this study by the course faculty. Therefore, it is possible that the lecture content along with independent reading influenced the results of the study. Moreover, there was ample time for participants enrolled in the study to discuss performance in the simulation experiences despite agreeing to maintain confidentiality.

The evaluation tools used to measure knowledge, skills and critical thinking may be another study limitation. Although the knowledge test was reviewed by nursing content experts, it was first piloted with participants in this study. Moreover, the factor analysis results demonstrated inconsistent reliability across the three time points of data collection. Piloting the knowledge test prior to the start of the study would have allowed revisions to be made to the questions, thus strengthening the test’s reliability. Additionally, the Creighton Competency Evaluation Instrument only showed fair reliability when looking specifically at the skills and critical thinking domains. While it is a standardized evaluation tool used in simulation, utilizing a more reliable tool would have enhanced study findings.

An additional limitation was the use of the same scenario before and after the treatment. It is possible that the improvements in knowledge, skills, critical thinking, and clinical judgment could be attributed to rehearsal. Participants may have anticipated the events of the scenario, which allowed them to respond more quickly and efficiently. Perhaps increasing the level of difficulty of each scenario across the three time points would have yielded different results.

Conclusion

It is evident in the literature that clinical competence is an essential skill for nurses to master in order to manage patients in higher acuity clinical settings. Therefore, education must provide the knowledge base of disease processes and management, and clinical opportunities to develop critical thinking and clinical judgment. However, as a result of the decreased effectiveness a traditional teaching methods coupled with limited clinical experiences, high fidelity simulation has emerged as a leading pedagogy in facilitating the development of clinical competence.

The results of this study provide evidence that high fidelity simulation is analogous to traditional instructional methods in facilitating improvements in all domains of clinical competence: knowledge, skills, critical thinking and clinical judgment. In addition, results of the present study suggest that high fidelity simulation enhances critical thinking ability in student learners more than traditional teaching. Therefore, the findings of this study lend support for more inclusion of high fidelity simulation into nursing curricula to improve clinical competence.

Future Implications

Since the competence model described in this study extends beyond simulation, more research is needed to determine how the refined schema is reframed as new information is presented in the clinical setting to establish competence. Moreover, this study focused on managing GI disorders, therefore further research is needed to establish the effectiveness of high fidelity simulation in developing competence in managing other disease processes. Once more research has been done in these specific areas, researchers can begin to conduct cost-benefit analyses to determine the utility of using high fidelity simulation in nursing curricula moving forward.

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Appendix A

Evidence-based Table on High-Fidelity Simulation and Learning Outcomes

Study Author & Year	Purpose	Design	Sampling	Human Subject Issues	Questions Concerning Interventions	Outcomes Measurement Tools	Adverse Effects of Intervention	Limitations	Statistics Used	Findings	Conclusion
Aqel & Ahmed, 2014	Examine the acquisition and retention of CPR knowledge and skills by using two methods of teaching a) traditional didactic CPR lecture accompanied with low fidelity simulation	Experimental pretest-posttest design	Convenience sample 90 nursing students enrolled in first adult health nursing course age 18-28,	Minimal Risk	Is there a difference in CPR knowledge between the control and intervention groups before initiation of CPR training? Will the intervention group receiving HFS and CPR	Outcomes: knowledge acquisition, skills acquisition, knowledge retention, skills retention Measurement tools: demographic data sheet, 14 question multiple choice test	Control group did not have an opportunity to receive the intervention	Knowledge and skills acquisition evaluated immediately after training. Therefore, further research is needed to determine appropriate time for post training.	Descriptive statistics, Independent sample t-test	No significant difference in baseline CPR knowledge between the control group (M=5.93, SD=1.15) and intervention group (M=5.78, SD 1.18).	HFS is effective in students' acquisition of knowledge and skills. CPR knowledge and skills were significantly decreased in both groups after 3 months of training. However the intervention group showed more retention of

	and b) didactic CPR lecture accompanied by HFS training	M=19.87, 19 male, 71 female, GPA self-report: 29 GPA weak, 34 GPA good, 27 GPA very good and excellent	training demonstrate higher level of CPR knowledge and skills acquisition than the control group receiving LFS and CPR training? Will the intervention group have a higher level of knowledge and skills retention 3 months after training in comparison to	from AHA, Adult CPR skills checklist by AHA		Both groups showed a gain in CPR knowledge with post-test scores for control group (M= 11.22, SD= 0.90) and intervention group (M=12.67, SD= 1.06). Significant difference in knowledge acquisition (t=-6.94) between two groups and skills acquisition	knowledge and skills.

	the control group?	(t= -5.44) in favor of intervention group Paired t-tests for knowledge and skills retention in the control group directly after training and 3 months later (t=8.14, t=10.50, respectively) Paired t-tests for knowledge and skills retention in the

	intervention group directly after training and 3 months later (t= 4.97, t=3.71, respectively). This indicates that both groups lost knowledge at 3 months. Retention of CPR skills in control group (M= 10.31 SD=1.88), Intervention group (M=12.80,

										SD= 1.44). T-test =-7.05 indicating that the intervention group had a significant increase in skills	
Brannan, White, & Bezanson, 2008	To report findings of a study that compared the effects of two instructional methods to teach specific nursing education content on junior level	Quasi-experimental pretest and post-test comparison group design	Convenience sample 107 junior level BSN students enrolled in adult health course	Minimal risk	Will baccalaureate nursing students who received instruction with HPS regarding clinical treatment of patients with acute myocardial infarction	Outcomes: cognitive skills, confidence Measuring Tools: Cognitive Skills Test (Acute Myocardial Infarction Questionnaire), Confidence Level Tool	One group did not receive the intervention	Students were not randomly assigned to intervention group.	t-test, paired sample t-test	Students who received HPS instructional method achieved significantly higher AMIQ post-test scores than did student who received the traditional	This study reveals that learner-centered strategies that actively engage students and involve decision-making and realistic patient responses may be more useful for students learning complex content.

nursing students' cognitive skills and confidence	demonstrate greater levels of cognitive skill and confidence?	lecture teaching approach (t=2.0, df=79, p=0.05). Confidence level among stuents who participated in the HPS instructional method was not found to significantly differ from those students who received the traditional lecture teaching approach

				(t=-1.74, df=81, p=0.09). Control group post-test confidence levels significantly improved across all four subscales. Intervention group experienced significantlhy improved confidence levels for assessment, planning, and

										implementation subscales.	
Coffman, Doolen, & Llasus, 2015	To describe the development of a simulation program, focusing on the concierge model. To evaluate the program using the Kirkpatric method to measure program outcomes.	Quasi-experimental design	Convenience sample 28 prelicensure BSN students no other demographic data provided	Minimal Risk	What was the students' reaction to simulation? Was there a change in knowledge after simulation? Was there a change in skill after simulation?	Outcomes: satisfaction, knowledge, skills Measurement Tools: questionnaire with quantitative rating scales and qualitative open-ended comments, Performance rubric	None. All participants completed the intervention 2 times	Survey results are unique to the program and cannot be generalized	Descriptive statistics, Wilcoxon matched pair test	Students appreciated that the simulation was not graded. Students recognized that experiencing tension during simulations was normal. Students reacted negatively to scenarios they thought were above	The program evaluation process should be designed and implemented within the context of each academic program to be meaningful.

their skill level or did not correspond to course content. There was no statistically significant difference in total pre and post summative scores based on achievement of performance measures (z=-.196, p.844). Students that participated

	in role-playing in the second session of each group did not perform significantly better than the students in the first session. Students in the second sessions formally identified the patient early (z= -2.449, p.014) and administered an expectorant

										more frequently (z= -.2449, p. 0.14)	
Elfrink, Kirkpatrick, Nininger, & Schubert, 2010	To inform teaching practices through the measurement of cognitive learning outcomes associated with human patient simulation.	Quasi-experimental single group pretest post-test design.	Convenience sample 84 students enrolled in prelicensure program (41 second year students enrolled in advanc	Minimal risk	Is there a difference in the subject-related knowledge of students from pre-to post simulation? Is there retention of subject – related knowledge? How can the findings from the pre/post-measurement and retention of learning	Outcomes: knowledge acquisition, knowledge retention Measuring Tools: 2 knowledge assessment questions, Matched questions on Final Examination	None. All participants received the intervention.	None Stated.	Descriptive frequencies, paired t-test, one sample t-test	10 participants answered both the pre and post-simulator questions correctly. 17 participants answered the post simulator questions correctly, while 11 students answered the pre and post simulator	This research h while limited to cognitive knowledge has provided valuable insight regarding the cues that students focus on in simulation s and need for clarity regarding the instructional cue sets presented.

	ed medical surgical course, 43 third-year students enrolled in high acuity course) No other demographic data provided	outcomes inform teaching practices for simulation?		questions incorrectly. The positive mean (0.375) indicates that students improved between pre and post- test (p=0.000). Using only participants that answered incorrectly before the simulation a one-sample t-test was performed, and determined that the mean

	was lower than the score expected by random guessing (1.75) and the difference is significant with p=0.001. Therefore participants who answered incorrectly on the pretest did significantly better than guessing on the post-test.

	23 participants answered the post-test question and the matched final examination question incorrectly. Using only the participants who had a correct answer after the simulation a one-sample t-test was performed, and determined

										that the mean score was lower than the score expected by random guessing (1.75), thus this difference is significant (p=0.000) Of the students who had the knowledge at the time of the post-test 93% retained the information.	
Gates, Parr, & Hughen,	To examine the effects of high-fidelity	Experimental design	Convenience Sample	Minimal risk	Research questions not stated.	Outcome: knowledge acquisition	None. All participants received the	All 12 clinical groups had a	Descriptive Statistics ANOVA	Students participating in the PE	The results indicate that for beginning

2012	simulation on nursing students' knowledge acquisition as evidenced by their performance on content-specific examinations.	104 students enrolled in medical-surgical course, age range 19-37, mean age 22.34; 13% make	Hypothesis tested: Students participating in a simulation experience will receive higher scores on examination of course content covered in the simulation than students who did not participate in the simulation.	Measuring Tools: 2 10-item NCLEX-type examinations	intervention.	different faculty member lead participants through the simulation and debriefing, there may be concerns that clinical groups may have had varying experiences due to differences in faculty knowledge, experience, and application of the	Hierarchical multi-regression analysis	simulation had an average PE examination score of 6.89 (SD=1.40). T tests indicated that this mean score was statistically different than the mean PE examination score obtained by the GI simulation group (6.08 (SD=1.41).	nursing medical-surgical undergraduate students participating in high-fidelity simulation is positively related to knowledge acquisition, as evidenced by higher scores on content-specific exminations.

	scripted debriefing questions. The sample size limits the generalizability of results.	The GI bleed mean examination score was significantly higher for those who participated in the GI bleed simulation (5.78; SD=1.15) versus those who participated in the PE simulation (4.92, SD=1.45). When the PE simulation variable was

added, the R^2 increased (0.105 to 0.186). The statistically significant beta coefficient of 0.81 indicates that holding everything else constant, participation in the PE simulation will raise a student's score on the PE examination by an

	average of 8.1 percentage points. When the GI simulation variable was added, the R2 increased (0.042-0.141). The statistically significant beta coefficient 0.86 indicates that holding everything else constant participation in the GI

										bleed simulation will on average increase score on the GI bleed examination by 8.6 percentage points.	
Grady et al., 2008	To examine the influence of mannequin fidelity levels on the learning of two common nursing procedures: nasogastric tube	Experimental cross over design	Convenience sample 39 first year nursing students. No other demographic inform	Minimal Risk	Is learning entry-level nursing procedures using high fidelity reactive simulator technology is superior to learning with relatively low-	Outcomes: skills acquisition Measuring Tools: Skills Checklist, Post-training questionnaire, post – evaluation questionnaire	None. All participants completed the intervention 2 times	Limited range of nursing procedures. The study findings do not account for long-term effects	t-tests, ANOVA	Training with high-fidelity mannequins led to significantly higher performance than did training with low-fidelity mannequins	The introduction of simulation technology supports positive pedagogical outcomes. Current results provide sufficient evidence to promote the use of high-fidelity mannequins in

insertion and indwelling urinary catheter insertion.	ation provide d.	fidelity simulator technology? A second hypothesis tested is the influence of gender on the acceptance of simulation		(F(1, 37) = 2.83, p<0.05) on Taylor Checklist. Students' attitudes were more positive after training with a high fidelity mannequin compared with the low fidelity mannequin (F(1, 37)= 3.22, p<0.05). Students' attitudes were more positive after	nursing education.

	training with the high-fidelity mannequin, compared with the low-fidelity mannequin (F(1,37) = 3.22, p<0.005). Students thought high fidelity mannequin provided a more realistic environment (t(37) = 1.57, p<0.10); provided more

				realistic feedback to their actions ($t(37) = 2.43$, $p<0.05$); responded in a way that helped them learn the procedures, ($t(37)= 1.37$, $p< 0.10$). Males and females performed equally as well on Taylor Checklist. Male students benefited from high

fidelity simulation more than female students ($t(37) = 1.69$, $p<0.05$). Male students had a more positive overall attitudes toward high-fidelity mannequin technology than did female students ($F(1,37) = 5.01$, $p<0.05$).

										No interaction between fidelity and gender was observed. Male students had a more positive attitude toward high fidelity simulation than low-fidelity simulation *t (11) = 1.90, $p<0.05$).	
Simulation Harris,	Determine the effect of a simulation-	Quasi-experimental design	Convenience Sample	Minimal Risk	Is there a difference in the	Outcomes: Critical thinking,	Control group did not have an	Small sample size results in the	Descriptive statistics, independen	There was no statistically significant	Study findings substantiate the effectiveness of a

2011	enhanced orientation on students' ability to critically think and make appropriate clinical decisions.	71 junior – level students enrolled in pediatric course. No other demographic data provided.	comprehensive pediatric examination scores between students who participated in a simulation-enhanced pediatric clinical orientation and students who did not? Is there a difference in the pediatric clinical grades between students who participated in a simulation-enhanced	clinical decisions Measurement tools: RN Nursing Care of Children Content Mastery Test, Clinical course grades	opportunity to receive the intervention	need to use caution when interpreting findings. Use of the Nursing Care of Children Content Mastery Test because it only had a few questions related to content presented in the scenarios.	t t-tests	difference in scores between the control group (M= 67.46, SD= 8.45,), and the intervention group (M= 65..33, SD= 6.86), t (27.7) = 1.06, p=0.19. Results for clinical grades were statistically significant in favor of intervention group t(75.3)= 5.2,	simulation enhanced pediatric clinical orientation

					pediatric clinical orientation and students who did not?					p<0.001. Clinical grades for control group (M= 3.4, SD= 0.3) and intervention group (M=3.7, SD=0.1)	
Hart, et al., 2014	To evaluate the effectiveness of a structured education curriculum with simulation	Quasi-experimental one-group repeated measures design	Convenience Sample 48 BSN students enrolled in	Minimal Risk	What is the effect of a structured education curriculum incorporating simulation training on undergraduate	Outcomes: Performance Measurement tools: Emergency Response Performance Tool	None. All participants completed the intervention	The sample was recruited from one BSN program making it difficult to draw conclusions	Descriptive statistics, one way repeated analysis of variance, Bonferroni adjustment for multiple	A significant effect was found comparing the groups' emergency response performance scores	The research demonstrates that students enrolled in a structured education course on acute patient deterioration that includes lecture, repeated training

training in improving undergraduate BSN students' performance in recognizing and responding to APD events	elective course 85% Caucasian, 85% female, Age range 20-51 with mean age 29.8 years (SD=9.41), 39 junior students, 9 senior students	BSN students' performance in recognizing and responding to APD events?		for all nursing programs. The program was not multidisciplinary making it difficult for transference to clinical practice to be understood. The study took place over 2 semesters resulting in the possibility of discussions between students	comparisons, Friedman test, Wilcoxon signed-rank test.	[F(1.29,11.58)= 11.529, p=.004]. The performance scores increased significantly from pre-intervention (M=51.00, SD= 35.85) to mid-intervention (M=95.10, SD= 5.82; p=.035). Performance from pre-intervention to post-intervention (M= 95.10, SD=5.82;	events, video review, and debriefing are able to significantly improve assessment skills, response time, efficiency, and effectiveness.

		enrolled in the first and second semester course offering. It is possible that students' memory of previous simulation experiences throughout the semester affected their performance.	p=.010). A significant effect was found comparing time to chest compressions [F (1.07,9.60)= 28.49, p<.001]. Time to chest compressions decreased significantly from pre-intervention (M=6:54 (SD=3:08) to mid-intervention (M=1:37,

SD=0:51; p=.002). The groups' time to chest compressions decreased significantly from pre-intervention (M=6:54, SD=3:08) to post-intervention (M=1:17, SD= 0:20, p=.001). A significant effect was found comparing time to bag-valve mask ventilation

		with high-flow oxygen [F (1.23,11.07) = 7.12, p=.018]. Time to Bag-valve mask ventilation decreased from pre-intervention (M=6:29, SD=3.15) to post-intervention (M=2:11, SD=0:22, p=.010). A significant effect was found comparing

time to electrical intervention [F (2,18)= 16.10, p<.001]. Time to electrical intervention decreased significantly from pre-intervention (M=8:10, SD= 2:20) to mid-intervention (M=4:11, SD= 3:04; p=.049) Time to electric intervention

							decreased significantly from pre-intervention (M=8:10, SD= 2:20) to post intervention (M=2:20; SD= 0:25; p<.001).There was a significant difference in patient survival outcome measured a pre, mid, and post-interventions, X^ 2 (2) = 15.000,

		p=.001).Post hoc analysis with Wilcoxon signed-rank tests was conducted with Bonferroni correction resulting in a significance level set at p<.017. Post survival outcome levels for pre-intervention [1.0 (1-1)]; mid-intervention [2.0 (1-3)],

										and post-intervention {3.0 (3-3)}. There was a significant difference in survival outcomes between pre-intervention and mid-intervention (Z=-2.236; p=.025); and between mid-intervention and post-intervention (Z=-3.162; p=.002).	
Hooper,	To determine	Ex post facto	Conven	Minimal Risk	Does student	Outcomes:	None. All	Some	Descriptive	The second	High-fidelity

Shaw, & Zamzam, 2015	if student knowledge increased on post-simulation quiz scores when only a few individuals had the opportunity to actively participate in the simulation while the remaining students observed the simulation in a large lecture hall.	design	ience sample 115 participants. 76 traditional and 39 second-degree baccalaureate nursing students enrolled in advanced level medical-surgica	knowledge increase when only a few individuals have an opportunity to actively participate in the simulation?	knowledge Measuring Tools: Post simulation quiz, Observer worksheet on QSEN competency	students were able to participate in the intervention at least once.	students expressed anxiety performing in front of their peers, which could have affected their performance. The student process, as students did not know if they were participating in the simulation or as acting or observing ahead of time. Pour acoustics in	statistics, paired t-test	degree students have a higher mean on all quizzes when compared with traditional students: Scenario 1 Traditional Pretest (M=85.79, SD=13.98) Post test (M=87.76, SD=15.02) Scenario 2 Traditional Pretest (M=87.44, SD= 13.24)	simulation is an option that can be implemented when working with large groups of nursing students, however careful planning and implementation are required to ensure success. The use of simulation provides an excellent approach for students to learn and practice QSEN competencies.

	l course.	the lecture hall made it challenging for some students to hear. Sample size was limited to once cohort for both traditional and second-degree programs. Since the design was ex post facto generalizing finding is limited.	Post test (M= 94.90, SD= 8.94) Scenario 3 Traditional Pretest (M= 82.37, SD= 18.47) Post test (M=82.60, SD= 19.50) Scenario 4 Traditional Pretest (M=88.44, SD=12.33) Post test (M=87.57, SD=13.66) Scenario 5 Traditional Pretest (M=92.27,

SD=11.72) Post test (M=96.33, SD 6.75) Scenario 6 Traditional Pretest (M=94.40, SD=7.59) Post test (M=87.58, SD=12.27) Scenario 1 2nd degree Pretest (M=93.59, SD= 11.81) Post test (M=96.15, 9.63) Scenario 2 2nd degree Pretest

(M=96.30, SD= 8.57) Post test (M=96.79, SD= 6.23) Scenario 3 2nd degree Pretest (M=92.31, SD=11.80) Post test (M=94.87, SD=13.36) Scenario 4 2nd degree Pretest (M=95.52, SD= 9.13) Post test (M=93.17, SD= 11.84) Scenario 5 2nd degree

Pretest (M=98.72, SD=4.79) Post test (M=99.36, SD=4.00) Scenario 6 2nd degree Pretest (M=98.29, SD= 6.25) Post test (M=93.68, SD= 9.80) The traditional students had a statistically significant increase in the post-simulation quiz scores

on 2 scenarios (narcotic overdose and blood transfusion scenarios). There were no statistically significant increases in any of the post-simulation test scores for second-degree students. Both traditional and Second-degree

										students had a statistically significant decrease in the post-simulation test for the pulmonary embolism scenario Paired t-test results unavailable due to dysfunctional link (https://links.lww.com/NE/A181)	
Liaw et al., 2010	To evaluate the clinical performance	A quasi-experimental cross over	Convenience Sample	Minimal Risk	Will nursing students who receive	Outcomes: Clinical Performance	None. All participants received the	Homogenous convenience sample limits	Descriptive statistics,t-tests	Participants who received simulation	The use of simulation with problem-based

	of nursing students who participated in simulation training with problem-based discussion in managing crisis events in comparison with those that participated in only problem-based discussion.	design	63 particip ants enrolle d as 1 year BSN student s 30 student s in first cohort age range 20-22 (M=20, SD=1) 33 student s in the second	simulation training with problem-based discussion have superior clinical performance in managing a patient with respiratory distress than those who undergo only problem-based discussion? Will nursing students who receive simulation training with problem-based	Measurement Tools: Researcher developed checklists	intervention.	generalizatio n of results. Since the study was conducted within an existing module of study random assignment of students to groups could not occur. There was no pre-test of students' performance.	training with problem based discussion had a superior clinical performance in managing respiratory distress: SPBD group post-test scores M=20.08, SD=1.93) and PBD group post test scores (M=18.19, SD=2.55). However the difference	discussion provided a more effective way for students to learn how ot identify and manage a crisis event compared with the use of problem-based discussion alone. The results of the study give support for the inclusion of simulation-based learning into PBL.

	experimental cohort age range 20-22 (M=20.2, SD=.52) No other demographic data provided	discussion have superior clinical performance in managing a patient with acute chest pain than those who undergo only problem-based discussion?		between the overall mean scores between the two groups is small (t=2.23, p=0.034). Participants who received simulation training with problem based discussion had a superior clinical performance in managing acute chest pain: SPBD group post-

test scores (M=27.56, SD=2.15), PBD group post-test scores (M=23, SD=2.69). The SPBD group ha statistically significant higher scores on the post-test for chest pain than the PBD group on subcategories for both physical assessment (t=3.43,

										p=0.01) and immediate actions (t=4.1, p=0.01).	
Schlairet & Pollock, 2010	To examine the effect of clinical simulation on undergraduate nursing students' knowledge acquisition	Experimental 2x2 crossover design	Convenience sample 74 students enrolled in an undergraduate fundamentals course, age range 18-44,	Minimal Risk	Not specifically stated. Hypotheses tested: Clinical simulation in an undergraduate fundamentals of nursing course, teaches basic nursing care concepts as well as	Outcomes: Knowledge acquisition Measuring Tools: 25 - question multiple choice test from NCLEX-RN study book	None. All participants received the intervention.	Modest sample size, Low knowledge scores pre and post-test could have resulted from the relatively short intervention phase. Practice effects or interaction effects mus	t-tests Chi Square	t-tests showed no statistically significant difference on knowledge pre-test scores, course midterm grade, or final grade by semester or intervention group.	This study found simulated clinical experiences to be as effective as traditional clinical experiences regarding knowledge acquisition and found use in early placement of clinical simulation as an educational intervention.

	86% female, 68% Caucasian	traditional clinical experiences. Simulated clinical experiences followed by traditional clinical experiences as an intervention sequence teaches basic nursing concepts as well as the reverse sequence does.	be considered given the use of one version of the knowledge test.	T-test revealed significant knowledge score differences from pretest (M=60.05, SD= 9.30) to post-test 1 (M=62.68, SD= 8.54, t=-2.48, p=0.015, df=70), post test 1 to post test 2 (M=64.78, SD=9.35, t=-2.24, p=0.028, df=70), and pretest

	(M=60.11, SD= 9.32 to post-test 2 (M=64.61, SD = 9.39, t=-3.54, p=0.001, df= 69). Significant knowledge gain was observed following both simulated and traditional clinical experiences as primary interventions and as sequenced

interventions , although effect size was small. Difference between simulation and traditional clinical experiences as a primary or single intervention on the groups' post-test 1 knowledge scores was 0.49 (95% confidence interval (CI)=-3.58 to

	4.56) Finding the 95% CI on the difference =/- 5 points. The knowledge scores of the simulated and traditional clinical experience groups were determined to be statistically equivalent. For the intervention sequences, the observed

	differences between the simulated-traditional group and the traditional-simulated group for post-test 2 knowledge scores was -0.33 (95% CI=-4.77 to 4.11). The scores for the intervention sequences were also determined to be statistically equivalent.

Shinnick & Woo, 2013	To determine if critical thinking improves in prelicensure nursing students after a HPS experience using the Health Science Reasoning Test. To determine the predictors of higher critical thinking scores using 10 covariates suspected of	One group quasi-experimental pre-test, post-test design	Convenience Sample 154 nursing students from 3 schools enrolled in a BSN medical surgical course mean age 25.7, 88% female, 12% male	Minimal Risk	Will students that participate in HPS have improved critical thinking skills? Will students who are older, have had prior employment or prior simulation exposure have increased critical thinking scores after HPS?	Outcomes: Critical thinking Covariates: learning style, knowledge, self-efficacy Measurement Tools: Demographic questionnaire, Health Sciences Reasoning Test, Kolb Learning Style Inventory, 12-item HF Clinical Knowledge Pretest-Post-test, 12-item	None. All participants received the intervention.	Different faculty members gave the cardiac lecture at each site. Therefore, emphasis on HF may have varied from school to school. Timing of the second HSRT test for critical thinking was offered up to 2 weeks post-intervention This may	Descriptive statistics, paired t-tests, Chi Square analysis, multivariate logistic regression	Data distribution was normal and no violation of normality, linearity or homoscedasticity of residuals were detected. There was no evidence of outliers. There was no concerns for violation of assumptions, as tolerance values for all variables >.2775.	The study demonstrated simulation to be an effective learning modality for a clinical situation in HF in prelicensure nursing students. It also clearly identifies value to students who may not be exceptionally strong critical thinkers.

influencing knowledge or critical thinking (age, gender, prior simulation exposure, previous employment as a nurse helper, time employed as a nurse helper, learning style, baseline knowledge score, baseline self-efficacy in the	enrolled in medical surgical course	Likert Scale for self efficacy	have allowed students to encounter an HF situation during clinical. Students may have had different and unequal clinical experiences in HF. Previous exposure to simulation prior to this study resulting in a possible “dosing effect”	There was statistically significant gain in knowledge as demonstrated by an increased mean score 6.5 points ($p<0.001$). There was no statistically significant gains in critical thinking between pre-test and post-test. Paired t-tests actually reveal a

management of HF, prioritizing physician orders, and managing patient's fluid levels.	slight decline in HSRT scores (21.79+/14.72 and 21.31 =/-5.08; p=0.76, but not statistically significant. Of sample 71% (n=109) of participants scored <25 (low critical thinking category; 29% (n=45) scored ≥25 (high critical thinking) Logic

										regression demonstrates that the only predictors of high critical thinking were the variables of age – older students (p=0.01), baseline knowledge of HF (p=0.04), and self efficacy of 1 meaning “not at all confident” (p=.02)	
Simonell	To examine	Quasi-	Conven	Minimal risk	Research	Outcomes:	One group	Convenience	Paired	Simulation	Simulation has a

i & Paskausky, 2012	the effects of simulation on student performance in an undergraduate childbearing clinical course. To compare knowledge and skill development of nursing students exposed to simulation as part of their curriculum with those whose curriculum	experimental design	ience Sample 281 enrolled in undergraduate childbearing clinical course, 9 male, 272 females. No other demographic data provided		questions not stated. Specific aims: To evaluate the knowledge acquisition of students enrolled in a childbearing course who were exposed to simulation by comparing scores on pre-simulation and post-simulation tests. To compare the skill acquisition of students previously	knowledge acquisition, skills acquisition Measuring Tools: Clinical Performance grades, NCLEX-style final examination	did not receive the intervention.	sample, participation of the entire population of students enrolled, similarity of the control and experimental groups in academic achievement prior to the course offering	sample t-test, independent means t-test	was found to improve performance both NCLEX Style tests (first experience: t=18.754, df=142; second experience: t=4.809, df=142) (p,0.001). The difference between clinical performance grades of non-simulation and	positive effect on both knowledge and skill development. The results of the study suggest that simulated experiences replacing a limited number of traditional clinical days, coupled with didactic teaching methods, improve clinical competency skills and knowledge development. These findings support the use of simulation as a valid teaching

did not include simulation.	enrolled in a childbearing course who were not exposed to simulation with that of students for whom simulation had been incorporated. To compare knowledge acquisition of students previously enrolled in a childbearing course who were not exposed to simulation	simulation group were statistically significant with the simulation group performing higher (mean grade 91.67 compared with non-simulation group mean grade 89.75 (t=4.504, df=279; p<0.001) . The difference in both final examination scores and	tool.

	with that of students for whom simulation had been incorporated.			final course grades between the non-simulation and the simulation group statistically significant, with the simulation group performing higher with a mean final exam score of 79.13 (t=4.341, df=279, p<0.001) and a mean grade of

									88.33 (t=6.872, df=279, p<0.001) compared with the non-simulation group with a mean final examination score of 75.59 and a mean grade 85.08.	
Smith & Barry, 2011	Descriptive correlational post-test-only research design	Convenience Sample 48 BSN nurses enrolled in senior	Minimal risk	What are the outcomes(satisfaction, self-confidence, and learning) of a home care HPS simulation	Outcomes: student satisfaction, self-confidence, and learning Measuring Tools: 9-item sociodemogra	None. All participants received the intervention.	Reflects one small group of students from one nursing program. There is no comparison group to	Descriptive statistics, Mann-Whitney U test, Spearman's Rho	Mean satisfaction score was 22.8 (SD=2.284). There was no significant difference in the order of	The results of the study indicate that the use of HPS is also appropriate for providing home care simulation experiences. This research provides

	level community health course average age 25.51 (SD=5.43), 89.6% female, 77.1% White	experience for senior community health nursing students? How do senior community health students rate the presence of five design characteristics (objectives, support, problem solving, debriefing, and fidelity) in a HPS home care experience? Are any demographic	phic instrument, researcher developed 16 item cognitive test, Student Satisfaction and Self-Confidence in Learning Scale, Simulation Design Scale	strengthen generalizability. Researcher developed cognitive exam to measure the outcome of learning. Lack of instruments with established psychometric properties has been a barrier to the evaluation of the effectiveness of simulation.	the experience of home safety assessment or HPS scenario first (p= .128 for order, p=.407 for role). The mean score for self-confidence in learning scale was 34.31 (SD= 3.397) out of a possible 40. There was no significant difference in	evidence regarding the importance of considering the design characteristics of a simulation, including student support for providing care in an unfamiliar home environment.

	characteristics or design characteristics correlated with three student outcomes of a home care HPS experience for senior community health students? What components of a home simulation experience do senior level community health nursing students report	Using self report instruments to measure satisfaction and self-confidence.	the order of the experience of home safety assessment or HPS scenario first or role during experience (student nurse or observer) affected self confidence (p=.252 for order; p=.409 for role. The mean score on the 16 item multiple

	as positive and what components of a home care simulation experience do these students report need to be improved?		choice exam was 9.74 (SD=1.950) There was no significant difference in the order of the experience of home safety assessment or HPS scenario first or role during experience (student nurse or observer) on learning (p-.679 for order;

		p=.809 for role). Mean scores for each characteristic of the Simulation Design Scale were high, with most students reporting that they either agreed or strongly agreed. All design characteristics were significantly correlated with the outcomes of

satisfaction and self-confidence (p<.001). The design characteristic with the highest correlation was the characteristic "support" (r=.639, for satisfaction; r=.678 for self confidence. There were no significant correlations between all five design

		characteristics and the outcome of learning. Between the characteristics of age, gender, ethnicity, and experience with the three outcomes of satisfaction, self-confidence, and learning home care the only significant correlation was between

										experience with home care and self-confidence (r= -.328; p=.023). Open ended responses revealed that student were positive about the home care experience. Students would generally like more time and more simulations in the course.	
Wood &	To assess the	Quasi-	Conven	Minimal risk	Does a 2-hour	Outcomes:	One group	Small	Descriptive	Mean	Despite the

Toronto, 2012	influence of HPS practice on critical thinking dispositions in a sample of undergraduate nursing students.	experimental Design	ience Sample 85 second year nursing students enrolled in Campus Laboratory Health Assessment Course. 96% female, mean age 19.4		practice session with HPS improve overall CCTDI scores? Does a 2-hour practice session with HPS improve scores on any of the CCTDI subscales?	Critical Thinking Dispositions Measurement Tools: California Critical Thinking Disposition Inventory (CCTDI)	did not receive the intervention	sample size and homogenous nature of the groups, and data cannot be generalized.	statistics, t-test, paired sample t-test	CCTDI pretest score was 304.5 for experimental and 303.2 for control groups. Mean CCTDI post-test score was 311.3for experimental and 304.2 for control groups. Mean CCTDI pretest subscale scores ranged from 36.4-48 in	individual gains in dispositions , the strength of the intervention was probably not sufficient to significantly affect disposition score differences between groups. Given that HPS practice is costly in terms of personnel time, space, and technology the findings reported here merit further study.

	years, mean GPA 3.38		the experimental group. Mean CCTDI pretest subscale scores ranged from 38.2-47.1 in the control group. No significant differences between groups on CCTDI total scores or subscales. Higher mean post-test score total

scores compared with pretest total scores in experimental group (mean difference=6.54, $t=2.26$, $df=38$, $p<0.05$) Significant within group differences for experimental group students occurred on the CCTDI subscales of truth-seeking (mean

			difference=2.02, t=3.27, df=39, $p<0.01$) and judiciousness or maturity of judgment (mean difference=2.58, t=3.27, df=39, $p<0.01$). There was no significant difference from pretest to posttest on total scores or on any CCTDI subscales for control group.

Appendix B

Oral Recruitment Script

Hello, my name is Tamara Poole and I am currently enrolled in the Doctorate of Nursing Practice Program at DePaul University. As part of the requirements for graduation, I am conducting research entitled Simulation and Curriculum Integration: Does Simulation Improve Clinical Competence. This research will examine how the integration of high-fidelity simulation into a nursing fundamentals course influences learning outcomes. More specifically, this research will measure clinical competence as a learning outcome, which is comprised of knowledge and skill acquisition, critical thinking, and clinical judgment. This research will hopefully help nurse educators identify how to best incorporate high fidelity simulation in nursing courses across the curriculum to improve student learning outcomes.

If you agree to participate in this study, you will be asked to watch one online lecture and skills video during outside class time the first week of winter quarter 2017. This online lecture and skills video will provide you with a review of the theoretical content and skills needed to participate in the remaining research activities. All other research activities will occur during your scheduled lab session for NSG 301: Introduction to the Art & Science of Nursing I during weeks 2 and 5 of winter quarter 2017. You will be asked to complete a demographic data sheet and three 15-item multiple choice quizzes. You will also be asked to participate in simulation instruction where you will be taught using simulated patient scenarios, or traditional instruction where you will be taught using static manikins and task trainers. Performance in all simulation experiences will be video recorded and kept confidential. Only co-investigator Linda Bensfield, MSN, RN, CHSE, Simulation Coordinator and I will have access to the video recordings. Upon completion of the research all video recordings will be deleted. All instructional activities will be facilitated by myself or co-investigator Linda Bensfield, MSN, RN, CHSE, Simulation Coordinator. Research activities that are completed as part of your participation in this study will have no bearing on your final course grade. The total time commitment for your participation in this study is approximately 6 hours.

I would like to assure you that this research has been approved through the DePaul University Institutional Review Board. The final decision regarding participation in this research is yours. If you choose to participate you may withdraw anytime without consequence. Do you have any questions at this time?

If you are interested in participating in this research please read and sign the consent form. Co-investigator Angel Butron, MSN, RN, FNP, Assistant Clinical Professor will remain in the room to answer any additional questions and collect consent forms.

Appendix C

Scenario: Preoperative Care of the Patient Scheduled for a Cholecystectomy

History
Mr. Jones is a 67-year old male that presented to the emergency room with complaints of intermittent abdominal pain and nausea for the last several weeks. In the last two days, he suffered several bouts of vomiting that relieved the abdominal pain. An abdominal sonogram revealed multiple stones in the gall bladder and partial obstruction of the cystic duct by a stone and the gastroenterologist diagnosed symptomatic cholelithiasis and cholecystitis. The gastroenterologist scheduled the patient for a traditional cholecystectomy tomorrow morning. He tells the patient that it is necessary for him to be admitted to the hospital today so that his condition can be monitored. Currently, the patient exhibits abdominal pain radiating to the right shoulder, fever, and episodes of nausea and vomiting.

Past Medical History
Type II Diabetes
Hypertension
Allergies: penicillin (anaphylaxis)

Scenario Objectives
1. Complete a head-to toe physical assessment
2. Use clinical judgment to determine the need to administer medication while verifying the 5 rights
3. Demonstrate effective communication skills with patient and physician
4. Demonstrate proper insertion of a nasogastric tube

State	Events	Minimal Behaviors Expected
State #1 • Admitted to Medical Surgical unit with left hand IV in place running 0.9% NS at 75ml/hour and 16 Fr indwelling catheter in place with straw yellow urine output. Provider Admitting Orders 1. Patient NPO	• HR=102bpm • BP=122/76mmHg • RR=24 • Breath Sounds= Clear • Pupils equal • Requests “something for pain” • Complains of abdominal fullness • Rates abdominal pain 6/10, sharp in RUQ radiating to back • Bowel Sounds= hypoactive Tell learners when they inquire:	• Complete initial assessment and note abnormal findings • Examine healthcare provider’s orders and prioritize nursing care • Gives pain medication and antiemetic • Calls healthcare provider to clarify order regarding antibiotic. Reminds provider that the patient is allergic to penicillin

with ice chips 2. Complete initial assessment, then every 8hrs after 3. Insert nasogastric tube to low continuous suction 4. Administer meperidine 75mg IM every 6 hours prn for pain 5. Administer ticaracillin 3g IM every 6 hours 6. Administer promethazine 12.5mg IM every 6 hours as need for nausea • Provider will discuss treatment plan with attending physician and will provide more orders at that time	1. Temperature=37.7C 2. Pupils reactive to light 3. Entire abdomen firm and painful to light palpation 4. Skin pink, warm, dry	• If students question the order the provider will tell the student to hold the ticaracillin. • Inserts NG tube to low continuous suction • Verify NG tube placement using pH method • Communicates appropriately with patient

Modified scenario from Egan, Piper, Kindred, Fried, & Bailey, 2007

Appendix D

Scenario: Small Bowel Obstruction

History
Mr. Griffin is a 61-year-old male admitted to the medical surgical unit during shift change with complaints of acute abdominal pain. Nursing report states that Mr. Griffin presented to the emergency department with acute abdominal pain; abdominal distention, and a 3-day history of nausea, periumbilical pain, diarrhea, and anorexia. The patient described the pain as intermittent cramping belly pain. He denies fever and chills. The night nurse reports that the patient was given a dose of Morphine 10mg IM in the ED just before coming to the unit 10 minutes ago, that she has completed the admission intake, but has not performed an assessment of the patient. She also reports that the resident has evaluated the patient, but there are currently no written orders.

Past Medical/Surgical History
Hypertension
Crohn's disease (fistula in 2010 with bowel resection)
Tonsillectomy (1955)
Allergies: NKDA

Scenario Objectives
1. Complete a head-to toe physical assessment
2. Use clinical judgment to determine the need to administer medication while verifying the 5 rights
3. Demonstrate effective communication skills with patient and physician
4. Demonstrate proper insertion of a nasogastric tube

State	Events	Minimal Behaviors Expected
State #1 • Admitted to Medical Surgical unit Provider Admitting Orders • None	• HR=90bpm • BP=132/82mmHg • RR=22 • Breath Sounds= Clear • Pupils equal • Requests "something for pain" • Complains of abdominal pain 5/10 • Complains of nausea • Abdomen distended • Bowel Sounds= hyperactive in all 4 quadrants	• Complete initial assessment and note abnormal findings • Notify physician of abnormal findings

<u>Provider Telephone Orders</u> 1. Patient NPO 2. Complete assessments every 8 hours 3. Insert nasogastric tube to low-intermittent suction 4. Administer ondansetron 4mg IM once 5. morphine 10mg IM once • More orders will be implemented during morning rounds on the patient. All IM medication orders will be converted to IV orders once IV is in place.	Tell learners when they inquire: 1. Temperature=37.1C 2. Pupils reactive to light 3. Diffuse tenderness on light palpation of abdomen 4. Skin pink, warm, dry	• Examine healthcare provider's orders and prioritize nursing care • Question the administration of the pain medication • Administer antiemetic medication • If student questions the Morphine order the provider will instruct the student to hold the medication • Inserts NG tube to low intermittent suction • Verify NG tube placement using pH method • Communicates appropriately with patient

Modified scenario from Campbell and Daley, 2013

Appendix E

Scenario: Postoperative Ileus

History
Mrs. James is a 72-year old female admitted to the medical surgical unit 2 days status post an uneventful laparoscopic cholecystectomy. During report the nurse was told that the patient's IV came out, and that the IV team won't be able to start a new IV for at least an hour. The nurse is entering the patient's room to do the morning assessment. The nurse finds that the patient is complaining of nausea, vomiting, pain, and abdominal fullness.

Past Medical History
No significant past medical history
Allergies: No Known Drug Allergies

Scenario Objectives
1. Complete a head-to toe physical assessment
2. Use clinical judgment to determine the need to administer medication while verifying the 5 rights
3. Demonstrate effective communication skills with patient and physician
4. Demonstrate proper insertion of a nasogastric tube

State	Events	Minimal Behaviors Expected
State #1 1. Patient is on the Medical Surgical unit 2 days postop laporascopic cholecystectomy with left hand IV that is no longer infusing 0.45% NS at 100ml/hour because the IV came out. Current Orders 2. Monitor incisions for redness, drainage and warmth 3. Diet as tolerated 4. Activity as tolerated and encouraged 5. morphine sulfate	• HR=110bpm • BP=142/84mmHg • RR=24 • Temp=37.7C • Breath Sounds= Clear • Alert, oriented x 3 • Pupils equal • Complains of abdominal pain 8/10 • Bowel sounds= absent • Complains of nausea, vomiting and fullness Tell learners when they inquire: 1. Weight= 55kg 2. Pupils reactive to light 3. Flat affect 4. Has not been ambulating due to abdominal pain	• Complete initial assessment and notes abnormal findings • Notifies provider of abnormal findings • Asks provider to change the route of the medication order

5mg IV every 4 hours as needed for pain (last administered 3.5 hours ago) Provider Telephone Orders 1. NPO Status 2. morphine sulfate 5mg IM once 3. Insert nasogastric tube and connect to low-intermittent suction 4. Ambulate 3 times daily 5. Activity as tolerated 6. Intake and Output every shift	5. Abdomen firm and distended 6. Has not been eating because it is too much trouble	• Administer pain medication using the five rights • Insert the nasogastric tube and attach it to low intermittent suction • Verify NG tube placement using pH method

Modified scenario from Thompson, 2007

Appendix F

ID Code________________________ **Sub-Lab Group:** 1 2

Demographic Data Sheet

Please Note: You do not have to answer any questions you do not feel comfortable answering.

1. List your current age: ___________

2. Identify your gender

   Female Male Other

3. Provide your current GPA in the nursing program ___________

4. Circle the amount of healthcare experience you have
   a. None
   b. Less than 1 year
   c. 1-3 years
   d. 3-5 years
   e. 5 or more years

Appendix G

ID Code______________________ **Sub-Lab Group:** 1 2

Knowledge Quiz

Physical Assessment

1. A nurse is providing end of shift report and states that the client bilateral pedal pulses of 3+/4. How should the oncoming nurse interpret this finding?
    a. Increased pulse
    b. Absent pulse
    c. Weak pulse
    d. Bounding pulse
2. A nurse is completing a pain assessment for a client. What is the **MOST** accurate method of assessing pain?
    a. Assess the client's vital signs
    b. Ask the client to rate his pain on a 0-10 scale
    c. Observe the client for facial grimaces
    d. Ask the client if he has pain
3. A client returns to the unit from surgery with a blood pressure = 92/50mmHg, pulse=140, and respirations=32. What action should the nurse complete first?
    a. Contact the physician
    b. Continue to monitor vital signs regularly
    c. Administer medication
    d. There are no interventions needed at this time
4. A nurse is completing a physical assessment on a client. Which assessment data should be reported as an abnormal finding?
    a. Radial pulses 2+/4 bilaterally
    b. Lungs clear to auscultation bilaterally
    c. Hypoactive bowel sounds in all 4 quadrants
    d. Pupils PERRLA
5. A nurse is completing an assessment on a client admitted for fever and diarrhea. While assessing the client the nurse notes a slightly distended abdomen. How should the nurse proceed with the rest of the abdominal assessment?
    a. Auscultation, Percussion, Palpation
    b. Palpation, Auscultation, Percussion
    c. Percussion, Palpation, Auscultation
    d. Palpation, Percussion, Auscultation

Medication Administration

1. A nurse is reviewing the medication orders for a client with an allergy to penicillin. Which order(s) should the nurse question?
    a. ceftriaxone 1g intravenous daily
    b. erythromycin 500mg orally every 12 hours
    c. penicillin V 500mg orally twice daily
    d. Answers A and C
2. A nurse is preparing to administer meperidine 50mg intramuscularly to a client. What is the most appropriate location to administer this medication?
    a. The Abdomen
    b. The Deltoid
    c. The Thigh
    d. The fatty aspect of the arm
3. A nurse is preparing to administer medication to a client. What is the **MOST** appropriate method of verifying the client's identity?
    a. Scan the client's ID band
    b. Ask the client to state his name
    c. Verify the client's name and room number
    d. Ask the client to state his name and date of birth
4. A nurse is preparing supplies to administer an intramuscular injection of ondansetron 4mg to an adult client. What would be the **MOST** appropriate needle selection?
    a. 25 gauge 3/8 inch needle
    b. 25 gauge 5/8 inch needle
    c. 25 gauge ½ inch needle
    d. 25 gauge 1 inch needle
5. A physician prescribes morphine 5 mg intramuscularly every 4 hours as needed for pain. The vial reads 1mg/ml. How many milliliters will the nurse administer?
    a. 2.5ml
    b. 5ml
    c. 10ml
    d. 1ml

Nasogastric Tube

1. A nurse is preparing to insert a nasogastric tube in an adult client. What is the most accurate method of determining how far the tube should be inserted?
    a. Mark the tube at 6 inches
    b. Measure from the earlobe to the tip of the nose and then to the sternum
    c. Mark the tube at 8 inches
    d. Measure from the tip of the nose to the earlobe, and then down to the xyphoid process.

2. A nurse is preparing to remove a nasogastric tube from a client. To remove the tube properly which action will the nurse ask the client to perform?
    a. Exhale
    b. Perform Valsalva maneuver
    c. Take a deep breath and hold
    d. The client is not required to perform any actions
3. A nurse has just inserted a nasogastric tube into a client for gastric decompression. Which of the following is the best indication that the tube is properly placed in the stomach?
    a. Aspiration of clear-colored mucus
    b. Green aspirate with a pH of 4
    c. Auscultation of a swish with the injection of air
    d. There patient stops vomiting
4. What is the appropriate position to place a client in for nasogastric tube insertion?
    a. High Fowler’s
    b. Supine
    c. Prone
    d. Sims
5. Which of the following will the nurse use to lubricate the nasogastric tube prior to insertion?
    a. Petroleum jelly
    b. Lidocaine gel
    c. Water soluble lubricant
    d. Chlorhexidine gel

Appendix H

Lasater Clinical Judgment Rubric

Dimension	Exemplary	Accomplished	Developing	Beginning
Effective noticing involves?				
Focused Observation	Focuses observation appropriately; regularly observes and monitors a wide variety of objective and subjective data to uncover any useful information	Regularly observes and monitors a variety of data, including both subjective and objective; most useful information is noticed; may miss the most subtle signs	Attempts to monitor a variety of subjective and objective data but is overwhelmed by the array of data; focuses on the most obvious data, missing some important information	Confused by the clinical situation and the amount and kind of data; observation is not organized and important data are missed, and/or assessment errors are made
Recognizing deviations from expected patterns	Recognizes subtle patterns and deviations from expected patterns in data and uses these to guide the assessment	Recognizes most obvious patterns and deviations in data and uses these to continually assess	Identifies obvious patterns and deviations, missing some important information; unsure how to continue the assessment	Focuses on one thing at a time and misses most patterns and deviations from expectations; misses opportunities to refine the assessment
Information Seeking	Assertively seeks information to plan intervention: carefully collects useful subjective data from observing and interacting with the patient and family	Actively seeks subjective information about the patient's situation from the patient and family to support planning interventions; occasionally does not pursue important leads	Makes limited efforts to seek additional information from the patient and family; often seems not to know what information to seek and/or pursues unrelated information	Is ineffective in seeking information; relies mostly on objective data; has difficulty interacting with the patient and family and fails to collect important subjective data
Effective interpreting involves:				
Prioritizing data	Focuses on the most relevant and important data useful for explaining the patient's condition	Generally focuses on the most important data and seeks further relevant information but also may try to attend to less pertinent data	Makes an effort to prioritize data and focus on the most important, but also attends to less relevant or useful data	Has difficulty focusing and appears not to know which data are most important to the diagnosis; attempts to attend to all available data
Making sense of data	Even when facing complex, conflicting, or confusing data, is able to (a) note and make sense of	In most situations, interprets the patient's data patterns and compares with known patterns to	In simple, common, or familiar situations, is able to compare the patient's data patterns with those	Even in simple, common, or familiar situations, has difficulty interpreting or making sense of

	patterns in the patient's data, (b) compare these with known patterns (from the nursing knowledge base, research, personal experience, and intuition), and (c) develop plans for interventions that can be justified in terms of their likelihood of success	develop an intervention plan and accompanying rationale; the exceptions are rare or in complicated cases where it is appropriate to seek the guidance of a specialist or a more experienced nurse	known and to develop or explain intervention plans; has difficulty, however, with even moderately difficult data or situations that are within the expectations of students; inappropriately requires advice or assistance	data; has trouble distinguishing among competing explanations and appropriate interventions, requiring assistance both in diagnosing the problem and developing an intervention
Effective responding involves:				
Calm, confident manner	Assumes responsibility; delegates team assignments; assesses patients and reassures them and their families	Generally displays leadership and confidence and is able to control or calm most situations; may show stress in particularly difficult or complex situations	Is tentative in the leader role; reassures patients and families in routine and relatively simple situations, but becomes stressed and disorganized easily	Except in simple and routine situations, is stressed and disorganized, lacks control, makes patients and families anxious or less able to cooperate
Clear communication	Communicates effectively; explains interventions; calms and reassures patients and families; directs and involves team members, explaining and giving directions; checks for understanding	Generally communicates well; explains carefully to patients; gives clear directions to team; could be more effective in establishing rapport	Shows some communication ability (e.g., giving directions); communication with patients, families, and team members is only partly successful; displays caring but not competence	Has difficulty communicating; explanations are confusing; directions are unclear or contradictory; patients and families are made confused or anxious and are not reassured
Well-planned intervention/ flexibility	Interventions are tailored for the individual patient; monitors patient progress closely and is able to adjust treatment as indicated by patient response	Develops interventions on the basis of relevant patient data; monitors progress regularly but does not expect to have to change treatments	Develops interventions on the basis of the most obvious data; monitors progress but is unable to make adjustments as indicated by the patient's response	Focuses on developing a single intervention, addressing a likely solution, but it may be vague, confusing, and/or incomplete; some monitoring may occur
Being Skillful	Shows mastery of necessary nursing skills	Displays proficiency in the use of most nursing skills; could improve in speed or accuracy	Is hesitant or ineffective in using nursing skills	Is unable to select and/ or perform nursing skills

Effective reflecting involves:				
Evaluation/self-analysis	Independently evaluates and analyzes personal clinical performance, noting decision points, elaborating alternatives, and accurately evaluating choices against alternatives	Evaluates and analyzes personal clinical performance with minimal prompting, primarily about major events or decisions; key decision points are identified, and alternatives are considered	Even when prompted, briefly verbalizes the most obvious evaluations; has difficulty imagining alterative choices; is self-protective in evaluating personal choices	Even prompted evaluations are brief, cursory, and not used to improve performance; justifies personal decisions and choices without evaluating them
Commitment to improvement	Demonstrates commitment to ongoing improvement; reflects on and critically evaluates nursing experiences; accurately identifies strengths and weaknesses and develops specific plans to eliminate weaknesses	Demonstrates a desire to improve nursing performance; reflects on and evaluates experiences; identifies strengths and weaknesses; could be more systematic in evaluating weaknesses	Demonstrates awareness of the need for ongoing improvement and makes some effort to learn from experiences and improve performance but tends to state the obvious and needs external evaluation	Appears uninterested in improving performance or is unable to do so; rarely reflects; is uncritical of himself or herself or overly critical (given level of development); is unable to see flaws or need for improvement

Lasater, K. (2007). Clinical judgment development: Using simulation to create an assessment rubric. *Journal of Nursing Education, 46*(11), 496-503.

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Lasater Clinical Judgment Rubric Scoring Sheet

Student Name **Observation Date/Time** **Scenario #:**

Clinical Judgment	Observation Notes
Components of Noticing: • **Focused Observation:** **E A D B** • **Recognizing Deviations from Expected Patterns:** **E A D B** • **Information Seeking?** **E A D B**	
Interpreting: • **Prioritizing Data:** **E A D B** • **Making Sense of Data:** **E A D B**	
Responding: • **Calm, Confident Manner:** **E A D B** • **Clear Communication:** **E A D B** • **Well-Planned Intervention/ Flexibility:** **E A D B** • **Being Skillful:** **E A D B**	
Reflecting: • **Evaluation/Self-Analysis:** **E A D B** • **Commitment to Improvement:** **E A D B**	
Summary Comments:	

Cato, M., Lasater, K., & Peeples, A. (2009). Nursing students' self-assessment of their simulation experiences. *Nursing Education Perspectives, 30*(2), 105-108.

Appendix I

Creighton Competency Evaluation Instrument (CCEI)

Student Name: ______________________

Staff Nurse Instructor Name: ______________________

0= Does not demonstrate competency
1= Demonstrates competency
NA= Not applicable

Date: ____/____/____ MM / DD / YYYY

Circle Appropriate Score for all Applicable Criteria - If not applicable, circle NA				COMMENTS:
ASSESSMENT				
1. Obtains Pertinent Data	0	1	NA	
2. Performs Follow-Up Assessments as Needed	0	1	NA	
3. Assesses the Environment in an Orderly Manner	0	1	NA	
COMMUNICATION				
4. Communicates Effectively with Intra/Interprofessional Team (TeamSTEPPS, SBAR, Written Read Back Order)	0	1	NA	
5. Communicates Effectively with Patient and Significant Other (verbal, nonverbal, teaching)	0	1	NA	
6. Documents Clearly, Concisely, & Accurately	0	1	NA	
7. Responds to Abnormal Findings Appropriately	0	1	NA	
8. Promotes Professionalism	0	1	NA	
CLINICAL JUDGMENT				
9. Interprets Vital Signs (T, P, R, BP, Pain)	0	1	NA	
10. Interprets Lab Results	0	1	NA	
11. Interprets Subjective/Objective Data (recognizes relevant from irrelevant data)	0	1	NA	
12. Prioritizes Appropriately	0	1	NA	
13. Performs Evidence Based Interventions	0	1	NA	
14. Provides Evidence Based Rationale for Interventions	0	1	NA	
15. Evaluates Evidence Based Interventions and Outcomes	0	1	NA	
16. Reflects on Clinical Experience	0	1	NA	
17. Delegates Appropriately	0	1	NA	
PATIENT SAFETY				
18. Uses Patient Identifiers	0	1	NA	
19. Utilizes Standardized Practices and Precautions Including Hand Washing	0	1	NA	
20. Administers Medications Safely	0	1	NA	
21. Manages Technology and Equipment	0	1	NA	
22. Performs Procedures Correctly	0	1	NA	
23. Reflects on Potential Hazards and Errors	0	1	NA	

COMMENTS

Total: ____________

Total Applicable Items: ____________

Earned Score ____________

Revised for DEU use 8/20/2013

Appendix J

Student Version of Scenarios

Scenario 1: Preoperative Care of the Patient Scheduled for a Cholecystectomy
History
Mr. Jones is a 67-year old male that presented to the emergency room with complaints of intermittent abdominal pain and nausea for the last several weeks. In the last two days, he suffered several bouts of vomiting that relieved the abdominal pain. An abdominal sonogram revealed multiple stones in the gall bladder and partial obstruction of the cystic duct by a stone and the gastroenterologist diagnosed symptomatic cholelithiasis and cholecystitis. The gastroenterologist scheduled the patient for a traditional cholecystectomy tomorrow morning. He tells the patient that it is necessary for him to be admitted to the hospital today so that his condition can be monitored. Currently, the patient exhibits abdominal pain radiating to the right shoulder, fever, and episodes of nausea and vomiting.

Past Medical History
Type II Diabetes
Hypertension
Allergies: penicillin (anaphylaxis)

Scenario 2: Small Bowel Obstruction
History
Mr. Griffin is a 61-year-old male admitted to the medical surgical unit during shift change with complaints of acute abdominal pain. Nursing report states that Mr. Griffin presented to the emergency department with acute abdominal pain; abdominal distention, and a 3-day history of nausea, periumbilical pain, diarrhea, and anorexia. The patient described the pain as intermittent cramping belly pain. He denies fever and chills. The night nurse reports that she has completed the admission intake, but has not performed an assessment of the patient. She also reports that the resident has evaluated the patient, but there are currently no written orders.
Past Medical/Surgical History
Hypertension
Crohn's disease (fistula in 2010 with bowel resection)
Tonsillectomy (1955)
Allergies: No Known Drug Allergies

Scenario 3: Postoperative Ileus
History
Mrs. James is a 72-year old female admitted to the medical surgical unit status post an uneventful laparoscopic cholecystectomy. Today is postoperative day two and the nurse is entering the patient's room to do the morning assessment. The nurse finds that the patient is complaining of nausea, vomiting, pain, and abdominal fullness.
Past Medical History
No significant past medical history

Allergies: No Known Drug Allergies

Objectives for all Scenarios

5. Complete a head-to toe physical assessment
6. Use clinical judgment to determine the need to administer medication while verifying the 5 rights
7. Demonstrate effective communication skills with patient and physician
8. Demonstrate proper insertion of a nasogastric tube

Appendix K

Simulation Orientation Checklist

Clinical Group_______________________ **Number of Participants_______**

Review the Location of Supplies

1. ____Oxygen wall supply
2. ____Suction wall supply
3. ____Emergency equipment
4. ____Medication
5. ____Nasogastric tube supplies
6. ____Location of Patient ID Band

Review Assessment Locations on the Manikin

7. ____Pupil Response
8. ____Heart Sounds
9. ____Lung Sounds
10. ____Bowel Sounds
11. ____Palpation of Peripheral Pulses
12. ____Placement of Blood Pressure Cuff
13. ____Placement of Thermometer

Demonstrate

14. ___Operating wall suction

Practice

15. ___10 minutes to practice with the manikin

Appendix L

Sample Schedule of Learning Activities for Control Group

Control Sub-Clinical Group A

	Activity	Total Time
8:00a-8:05a	Complete Data Sheet	5 minutes
8:05a-8:20a	15 Question Quiz	15 minutes
8:20a-8:25a	Prebrief Baseline Scenario	5 minutes
8:25a-8:50a	Baseline Scenario	25 minutes
8:50a-9:15a	Debrief Baseline Scenario	25 minutes
9:15a-9:20a	Break	5 minutes
9:20a-10:20a	Traditional Skills Instruction/Practice	1 hour
10:20a-10:25a	Break	5 minutes
10:25-10:40a	Repeat 15 Question Quiz	15 minutes
10:40a-10:45a	Prebrief Repeat Baseline Scenario	5 minutes
10:45a-11:10a	Repeat Baseline Scenario	25 minutes
11:10a-11:35a	Debrief Repeat Baseline Scenario	25 minutes

Control Sub-Clinical Group B

	Activity	Total Time
8:25a-8:30a	Complete Data Sheet	5 minutes
8:30a-8:45a	15 Question Quiz	15 minutes
8:45a-8:50a	Prebrief Baseline Scenario	5 minutes
8:50a-9:15a	Baseline Scenario	25 minutes
9:15a-9:40a	Debrief Baseline Scenario	25 minutes
9:40a-9:45a	Break	5 minutes

9:45a-10:45a	Traditional Skills Instruction/Practice	1 hour
10:45a-10:50a	Break	5 minutes
10:50a-11:05a	Repeat 15 Question Quiz	15 minutes
11:05a-11:10a	Prebrief Repeat Baseline Scenario	5 minutes
11:10a-11:35a	Repeat Baseline Scenario	25 minutes
11:35a-12:00p	Debrief Repeat Baseline Scenario	25 minutes

Sample Schedule of Learning Activities for Intervention Group

Intervention Sub-Clinical Group A

	Activity	Total Time
8:00a-8:05a	Complete Data Sheet	5 minutes
8:05a-8:20a	15 Question Quiz	15 minutes
8:20a-8:25a	Prebrief Baseline Scenario	5 minutes
8:25a-8:50a	Baseline Scenario	25 minutes
8:50a-9:15a	Debrief Baseline Scenario	25 minutes
9:15a-9:20a	Break	5 minutes
9:20a-9:25a	Prebrief Intervention Scenario	5 minutes
9:25a-9:50a	Intervention Scenario	25 minutes
9:50a-10:15a	Debrief Intervention Scenario	25 minutes
10:15a-10:20a	Break	5 minutes
10:20a-10:35a	Repeat 15 Question Quiz	15 minutes
10:35a-10:40a	Prebrief Repeat Baseline Scenario	5 minutes
10:40a-11:05a	Repeat Baseline Scenario	25 minutes

11:05a-11:30a	Debrief Repeat Baseline Scenario	25 minutes

Intervention Sub-Clinical Group B

	Activity	**Total Time**
8:30a-8:35a	Complete Data Sheet	5 minutes
8:35a-8:50a	15 Question Quiz	15 minutes
8:50-8:55a	Prebrief Baseline Scenario	5 minutes
8:55a-9:20a	Baseline Scenario	25 minutes
9:20a-9:45a	Debrief Baseline Scenario	25 minutes
9:45a-9:50a	Break	5 minutes
9:50a-9:55a	Prebrief Intervention Scenario	5 minutes
9:55a-10:20a	Intervention Scenario	25 minutes
10:20a-10:45a	Debrief Intervention Scenario	25 minutes
10:45a-10:50a	Break	5 minutes
10:50a-11:05a	Repeat 15 Question Quiz	15 minutes
11:05a-11:10a	Prebrief Repeat Baseline Scenario	5 minutes
11:10a-11:35a	Repeat Baseline Scenario	25 minutes
11:35a-12:00p	Debrief Repeat Baseline Scenario	25 minutes

Appendix M

Prebrief Guides

Baseline Scenario: Preoperative Care of the Patient Scheduled for a Cholecystectomy

History

Mr. Jones is a 67-year old male that presented to the emergency room with complaints of intermittent abdominal pain and nausea for the last several weeks. In the last two days, he suffered several bouts of vomiting that relieved the abdominal pain. An abdominal sonogram revealed multiple stones in the gall bladder and partial obstruction of the cystic duct by a stone and the gastroenterologist diagnosed symptomatic cholelithiasis and cholecystitis. The gastroenterologist scheduled the patient for a traditional cholecystectomy tomorrow morning. He tells the patient that it is necessary for him to be admitted to the hospital today so that his condition can be monitored. Currently, the patient exhibits abdominal pain radiating to the right shoulder, fever, and episodes of nausea and vomiting.

Past Medical History

Type II Diabetes

Hypertension

Allergies: penicillin (anaphylaxis)

Start of Scenario

Participants will begin the scenario be entering the patient's room to introduce themselves and complete an assessment.

Scenario Objectives

1. Complete a head-to toe physical assessment
2. Use clinical judgment to determine the need to administer medication while verifying the 5 rights
3. Demonstrate effective communication skills with patient and physician
4. Demonstrate proper insertion of a nasogastric tube

Role Assignment

There are no assigned roles for this scenario.

Scenario Time

Participants will have 25 minutes to complete the scenario. The scenario will end at this time.

Intervention Scenario: Small Bowel Obstruction

History

Mr. Griffin is a 61-year-old male admitted to the medical surgical unit during shift change with complaints of acute abdominal pain. Nursing report states that Mr. Griffin presented to the emergency department with acute abdominal pain; abdominal distention, and a 3-day history of nausea, periumbilical pain, diarrhea, and anorexia. The patient described the pain as intermittent cramping belly pain. He denies fever and chills. The night nurse reports that she has completed the admission intake, but has not performed an assessment of the patient. She also reports that the resident has evaluated the patient, but there are currently no written orders.

Past Medical/Surgical History

Hypertension

Crohn's disease (fistula in 2010 with bowel resection)

Tonsillectomy (1955)

Allergies: morphine (rash)

Start of Scenario

Participants will begin the scenario be entering the patient's room to introduce themselves and complete an assessment.

Scenario Objectives

9. Complete a head-to toe physical assessment
10. Use clinical judgment to determine the need to administer medication while verifying the 5 rights
11. Demonstrate effective communication skills with patient and physician
12. Demonstrate proper insertion of a nasogastric tube

Role Assignment

There are no assigned roles for this scenario.

Scenario Time

Participants will have 25 minutes to complete the scenario. The scenario will end at this time.

Advanced Scenario: Postoperative Ileus

History

Mrs. James is a 72-year old female admitted to the medical surgical unit status post an uneventful laparoscopic cholecystectomy. Today is postoperative day two and the nurse is entering the patient's room to do the morning assessment. The nurse finds that the patient is complaining of nausea, vomiting, pain, and abdominal fullness.

Past Medical History

No significant past medical history

Allergies: No Known Drug Allergies

Start of Scenario

Participants will begin the scenario be entering the patient's room to introduce themselves and complete an assessment.

Scenario Objectives

1. Complete a head-to toe physical assessment
2. Use clinical judgment to determine the need to administer medication while verifying the 5 rights
3. Demonstrate effective communication skills with patient and physician
4. Demonstrate proper insertion of a nasogastric tube

Role Assignment

There are no assigned roles for this scenario.

Scenario Time

Participants will have 25 minutes to complete the scenario. The scenario will end at this time.

Appendix N

Debrief Guide All Scenarios

1. How did you feel taking care of the patient?
2. How did you work as a team to prioritize care for the patient?
3. What assessments did you perform on the patient? Were they completed correctly? Was anything missed?
4. What assessment data lead you to identifying the primary problem(s) for this patient?
5. What interventions did you perform?
6. Why was the NG tube necessary?
7. What went well with the NG tube insertion? What could be improved?
8. How would you have handled if the NG tube got stuck on insertion?
9. How would you have removed the tube if needed after it was in place?
10. How did you determine what medications to administer?
11. Were medications administered appropriately?
12. Did you question any medication orders? If so, why?
13. What prompted you to contact the provider?
14. Describe your SBAR communication. What components went well? What could improve
15. In summary, what are the key takeaways from this scenario that can be applied to your clinical practice?