

QUANTIFYING THE INFLUENCE OF EXPERT MODELING ON NOVICE NURSE
COMPETENCE AND SELF-EFFICACY

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ABSTRACT

QUANTIFYING THE INFLUENCE OF EXPERT MODELING ON NOVICE NURSE
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Background: Because of the complex needs of hospitalized patients today, strategies to improve nurses' competence are of growing interest. Simulation is one way in which nursing education addresses the development of competence and self-efficacy. Several studies have measured competence in simulation objectively, and some have explored how self-efficacy influences competence. Evidence related to the impact of pre-simulation assignments on novice nurses' competence and self-efficacy, however, has yet to be established. Accordingly, the purpose of this body of research was to examine how various simulation preparation methods enhance novice nurses' competence and increase self-efficacy.

Methods: Three quantitative analyses were performed. First, a preliminary analysis included in this body of research was a review and meta-analysis of 43 nursing education studies where self-efficacy was measured as an outcome of simulation. Second, the psychometric properties of three National League for Nursing simulation evaluation scales, which have been widely used with samples of novice nurses, were quantified.

Third, a parallel, blinded, randomized trial was used with three simulation preparation groups (expert modeling/intervention, voice over PowerPoint/active control, and traditional reading assignments/passive control) to measure the influence of simulation preparation on novice nurses' competence and self-efficacy. Participants were senior, undergraduate novice nurses enrolled in an integrative practicum clinical course at a nursing school in the Pacific Northwest region of the United States.

Results: Simulation positively influences novice nurses' self-efficacy. Expert modeling and voice over PowerPoint further increase novice nurses' self-efficacy for providing care to multiple patients in simulation. Additionally, expert modeling increases competence more than voice over PowerPoint and reading assignments used as simulation preparation. Change in self-efficacy and competence are not statistically related in the context on multiple patient simulation. Results from a psychometric study provide evidence of validity and reliability for a self-efficacy scale that is frequently used in simulation evaluation.

Conclusion: General inferences drawn from this body of research serve as evidence to support simulation in academic and practice settings. This body of research supports nurse educators using expert modeling videos and voice over PowerPoint as simulation preparation for novice nurses in complex simulations. Moreover, this research has revealed more unanswered questions related to novice nurses' competence and self-efficacy and provided direction for future work.

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Chapter I — INTRODUCTION

Background and Significance

Simulation is a teaching strategy to improve and validate the sophisticated skills required of health care professionals (National Council of State Boards of Nursing, 2005). Simulation mimics the reality of a clinical environment while providing participants with opportunities to demonstrate critical thinking, skilled procedures, and decision-making (Jeffries, 2005) and develop processes such as clinical reasoning, self-regulation and metacognition (Jeffries, 2007). Although simulation has been used in aeronautics (Billings & Reynard, 1984; Ruffell-Smith, 1979) and medical education (Gaba, 2004) for many years, the principles of simulation have only been recently formalized in nursing education. Simulation is a constructivist, contextual, experiential, and problem-solving pedagogy (Dreifuerst, 2010), meaning simulation builds on past experiences and involves participants in real-time learning within the context of a patient scenario. Well-planned simulation can facilitate the development of novice nurses' competence, which might be otherwise overlooked by the complexity of care in traditional hospital-based clinical experiences (Dillard et al., 2009).

Simulation can bring together theory and practice for novice nurses and offer a forum to advance competence and clinical judgment (Dillard et al., 2009; Guhde, 2011; Jarzemsky & McGrath, 2008; Lasater, 2007; Liaw et al., 2010; Mould, White, & Gallagher, 2011). Novice nurses report that the breadth of simulation patients helps them better anticipate patient needs (Lasater, 2007). Similarly, novice nurses report that they appreciate time to slow down their thinking and practice skills in simulation without

feeling rushed to produce an outcome like they would in traditional hospital-based clinical experiences (Limoges, 2010).

Several elements of simulation likely influence the development of competence. First, cues provided during simulation can help focus the novice's attention (Endacott et al., 2011; Liaw et al., 2010) and therefore enable them to respond to patient needs (Bambini, Washburn, & Perkins, 2009; Cardoza & Hood, 2012; Cormier, Pickett-Hauber, & Whyte, 2010; Dillard et al., 2009; Liaw et al., 2010). Second, the social nature of simulation contributes to learning, and teamwork gives simulation legitimacy for health care professionals (Limoges, 2010). Third, guided debriefing discussions after simulation foster a sense of salience and conceptual understanding (Dreifuerst, 2010; Liaw et al., 2010; Raemer et al., 2011; Rudolph, Simon, Raemer, & Eppich, 2008; Rutherford-Hemming, 2012).

A majority of simulation experiences in nursing are implemented as short, independent scenarios interspersed throughout a curriculum. Novice nurses typically come to the simulation lab for a four-hour experience once per clinical course. Similarly, simulation research commonly encompasses a one-time scenario exposure (Bambini et al., 2009; Cormier et al., 2010; Dillard et al., 2009; Kaplan & Ura, 2010; Reese, Jeffries, & Engum, 2010; Selle, Salamon, Boarman, & Sauer, 2008). We know that novice nurses report an increased understanding of priority setting even after one-time simulation interventions (Bambini et al., 2009; Kaplan & Ura, 2010). Additionally, one-time simulations with interprofessional health care providers have increased participants' self-efficacy for collaboration and professional communication (Reese et al.; Selle et al.).

Unfortunately, empirical data from one-time simulations leaves much to be known about the overall impact of simulation over time.

By participating in a series of simulations, novice nurses may better recognize their own competence (Sportsman, Schumacker, & Hamilton, 2011). There also is evidence that repeated simulations increase novice nurses' awareness of their own physical assessment skills (Guhde, 2011; Liaw et al., 2010). Further, novice nurses report increased competence related to clinical judgment with simulation over time (Guhde, 2011; Mould et al., 2011). Thus, multiple stakeholders including nursing faculty, hospital employers, and the National Council of State Boards of Nursing (NCSBN) are interested in how programs of simulation shape novice nurses' competence.

A current theme in the simulation literature calls for investigations of how competence that is gained in simulation transfers to actual health care practice. There is a dearth of evidence depicting how simulation impacts actual practice, but the most promising results come from emergency/resuscitation simulations with nursing staff and medical students in acute care settings (Buckley & Gordon, 2011; Carpico & Jenkins, 2011; Domuracki, Moule, Owen, Kostandoff, & Plummer, 2009). Additionally, the NCSBN is conducting an ongoing, longitudinal study comparing groups of novice nurses who receive prescribed simulations during their curriculum and following those novice nurses into their first year of actual nursing practice (Hayden, Jeffries, & Kardong-Edgren, 2012). Further, there is a paucity of evidence related to cost savings or other benefits to employers after health care providers participate in simulation (Cohen et al., 2010). Unfortunately, most of the evidence for transfer to practice after simulation comes

from self-report forecasting (Abdo & Ravert, 2006; Feingold, Calaluce, & Kallen, 2004). Thus, there is a need for more longitudinal, empirical research addressing the impact of simulation on novice nurses' actual practice and sustainability of competence influenced by simulation.

Simulation

In this body of research, the term 'simulation' refers to use of low, medium, and high fidelity mannequins as well as Standardized Patient actors, role play, and activities in both formal simulation labs and in situ clinical sites (Jeffries, 2005). Through each of these activities, simulation can supplement learning in traditional clinical settings, laboratory activities, and didactic lecture (McCallum, 2007; Nehring, 2008; Weaver, 2011). Simulation is a teaching strategy largely embraced due to the belief that participants learn more effectively from hands-on experiences than other types of teaching strategies, such as lecture (Cioffi, Purcal, & Arundell, 2005; Solnick & Weiss, 2007).

Novice Nurses

Novice nurses — those who are in school or have practiced as a nurse for fewer than six months (Benner, Tanner, & Chesla, 2009) — comprise more than 10 percent of hospital staff nurses (Nursing Executive Center, 2007). It is a significant problem that novice nurses make more errors than experienced nurses (Committee on Quality of Health Care in America, 2001; del Bueno, 2005; Ebright, Urden, Patterson, & Chalko, 2004; Ironside, Jeffries, & Martin, 2009; Institute of Medicine, 2000, 2003; NCSBN, 2007; Saintsing, Gibson, & Pennington, 2011; Smith & Crawford, 2003). Most often

noted as being problematic for novice nurses is their inability to manage multiple responsibilities and anticipate changes in their patients' conditions (Berkow, Virkstis, Stewart, & Conway, 2008) that is likely related to concrete, rule-based thinking (Benner et al.). Novice nurses have theoretical knowledge, but have difficulty translating knowledge into actual nursing practice (del Bueno, 2005). Thus, there is great need to explore strategies to decrease novice nurses' errors as they transition to actual practice.

The impact of novice nurses on patient care is of growing concern because of the large number of novice nurses entering the workforce. More than 100,000 novice nurses completed basic nurse training programs in 2008 (National League for Nursing, 2008). Between 2005 and 2008, descriptive studies of novice nurses revealed that 50 percent of novice nurses would fail to recognize a life-threatening complication in a physical assessment (del Bueno, 2005). More than 40 percent of novice nurses reported making medication errors (Ebright et al., 2004; NCSBN, 2007; Smith & Crawford, 2003). Furthermore, 37 percent of novice nurses reported errors related to delays in treatment (Smith & Crawford). Therefore, it is quite clear that novice nurses' errors in practice and of omission can have a significant impact of patient outcomes.

Competence

A significant barrier to our understanding of the effect of simulation on competence is lack of a well-accepted definition for competence (Watson, Stimpson, Topping, & Porock, 2002). Academics might define competence as a group of qualities that someone possesses, without acknowledging specific tasks or procedures that person can master (Short, 1984). Additionally, there is a good deal of confusion about the

differences in meanings of the words competence, expertise, performance, and capability (Eraut, 1994; While, 1994). In nursing, competence frequently means that a nurse is able to perform to an expected standard with desirable outcomes (Benner, 1982; Eraut & Du Boulay, 1999; Nagelsmith, 1995; While). More specifically, competence might be defined as an effective application of knowledge and skills (del Bueno, 1990). In recent years, competence has been operationalized as knowledge, skills, and attitudes around which some nursing curricula are organized (Allen, Ramaekers, & van der Velden, 2005; Cronenwett et al., 2007). However, the fact that nurse scientists have not agreed upon a well-accepted definition of competence has contributed to a significant gap in the literature surrounding the effect of simulation on novice nurses' competence, with only one systematic review of literature being published thus far (McCallum, 2007).

It is important to recognize that competence in this body of research refers to a demonstrated set of behaviors, wherein competence can be measured objectively; however, this *competence* is different than the competent stage of development for nursing practice. In the competent stage, nurses are able to notice changes in a patient's situation and recognize the need for a subsequent re-direction in their goals and plan of care (Benner et al., 2009). Attaining such a competent stage of nursing practice usually occurs about two years after licensure, when nurses display increased clinical understanding, technical skills, organization, and an ability to anticipate a likely course of events (Benner et al.). It is unrealistic for educators to expect that novice nurses — those in school or in the first six months of practice — would be able to discriminate these clinical judgments, because novice nurses' judgments are instead characterized by a focus

on the present shift or task at hand and rule-based thinking (Benner et al.). Thus, use of competence as a dependent variable in this body of research describes a set of behaviors that lead to the desired outcome (Benner, 1982). The overarching purpose of interventions tested in this research is to enhance novice nurses' competence, wherein eventually they would be able to identify signs and symptoms representing a change in patient status, notice and understand the "big picture" of relationships between physiologic states, anticipate changes in patient condition, and alter care protocols when they approach the competent stage of practice (Benner et al.).

In this body of research, a particular focus will be given to novice nurses' competence in providing care to multiple patients in Chapters IV and VI. The preferred definition of competence used here comes from Dr. Patricia Benner, as described above. We know that skills related to competence are more readily taught in simulation and clinical settings than in a classroom (Bambini et al., 2009; Berkow et al., 2008; Guhde, 2010; Kaplan & Ura, 2010; Lasater, 2007; Mould et al., 2011; Radhakrishnan, Roche, & Cunningham, 2007). Further, it is generally accepted that simulation is effective at increasing novice nurses' competence in providing care to one patient (Adamson, 2012; Cardoza & Hood, 2012; LeFlore, Anderson, Michael, Engle, & Anderson, 2007; Leigh, 2008; Rockstraw, 2006). But, a key skill in modern nursing – competence in managing multiple patients – has seldom been studied in simulation research.

Multiple Patient Simulation

It is assumed that competence is central to managing multiple patients, because care of multiple patients requires skills like priority setting, time management,

organization, communication, and clinical judgment. These skills are actually *competencies* which document what a nurse knows and is able to do. Thus, there are multiple *competencies* embedded in the general competence to manage multiple patients. Four research teams have published multiple patient simulation studies (Frontiero & Glynn, 2012; Ironside et al., 2009; Kaplan & Ura, 2010; Radhakrishnan et al., 2007), all of which broadly focused on maintaining patient safety while providing care for two or more patients. Though the design of these studies is limited by self-report results (Kaplan & Ura), use of investigator-developed measures without psychometric support (Ironside et al.; Radhakrishnan et al.), and small sample size (Frontiero & Glynn; Radhakrishnan et al.), the collective results indicate that multiple patient simulation may positively influence novice nurses' competence.

A significant benefit of multiple patient simulation is the opportunity for novice nurses to practice skills that are not available to them in traditional hospital-based clinical experiences. Some examples of management skills applied in multiple patient simulation are the occasions for novice nurses to listen to report, organize their plan for multiple patients, prioritize focused physical assessments based on salient items from report, and administer medications to multiple patients all within a predetermined time frame (Kaplan & Ura, 2010; Radhakrishnan et al., 2007). Additionally, multiple patient simulation offers novice nurses the chance to practice technical nursing skills including hand hygiene, two patient identifiers, and safe medication administration (Frontiero & Glynn, 2012). Because multiple patient assignments are not frequently available to novice nurses in traditional hospital-based clinical experiences, it is important to consider

the need for repeated multiple patient simulations (Ironside et al., 2009) and targeted simulation preparation (Radhakrishnan et al.) to further influence novice nurses' competence.

Simulation Preparation

Though there has been significant research around outcomes from simulation, a major limitation is lack of investigation of the effect of simulation preparation methods. There are three general methods nurse educators use to help novice nurses prepare for simulation. First, historically it is common practice for educators to assign novice nurses articles or supporting materials to read in preparation for simulation (McCausland, Curran, & Cataldi, 2004), which help to orient novice nurses to the upcoming simulation (Rosen et al., 2010). Second, recent education trends suggest pre-recorded voice over PowerPoint lectures are effective ways to prepare novice nurses for simulation (Bergmann & Sams, 2012; Ferreri, 2013; Prober & Heath, 2012; Watters, 2012; Wolf & Massaro, 2013). Third, our novel approach involves a pre-simulation expert modeling video intervention to enhance competence (Anderson, Aylor, & Leonard, 2008; Johnson et al., 2012; Rosen et al., 2010; Selle et al., 2008). Each of these three preparation methods for simulation may increase novice nurses' competence. Accordingly, this body of research compares the impact of three pre-simulation preparation methods on novice nurses' competence and self-efficacy.

Self-Efficacy

Self-efficacy refers to a person's general sense of effectiveness (Smith, 1989), wherein one perceives they are capable of performing in a certain manner to achieve

specific goals (Bandura, 1986). Self-efficacy is essential to nurses' abilities and performance in the clinical setting (Dykes, 2011), because a nurses' self-efficacy can help them overcome situations in patient care which are distressing and evoke anxiety. Numerous studies have evaluated novice nurses' self-efficacy after participation in simulation (Bantz, Dancer, Hodson-Carlton, & Van Hove, 2007; Bremner, Aduddell, Bennett, & vanGeest, 2006; Cardoza & Hood, 2012; Eaves & Flagg, 2001; Henneman & Cunningham, 2005; Kuznar, 2007; Lasater, 2007; McCausland et al., 2004; Rockstraw, 2006); but, the results of findings across these and other studies on the influence of simulation on self-efficacy have never been quantitatively synthesized. Therefore, an important preliminary analysis included in this body of research is a detailed review and meta-analysis of 43 nursing education studies; results of the meta-analysis are presented in Chapter II.

Although it is generally accepted that simulation is effective at increasing novice nurses' self-efficacy (Adamson, 2012; Cardoza & Hood, 2012; LeFlore et al., 2007; Leigh, 2008; Rockstraw, 2006), measuring self-efficacy in nursing simulation is challenging because of lack of psychometric support for commonly used instruments. The National League for Nursing (NLN) Student Satisfaction and Self-Confidence in Learning scale (SCLS) was developed as a multi-dimensional, self-administered instrument that addresses novice nurses' attitudes about learning in simulation (Jeffries & Rizzolo, 2006). Since its development, the SCLS has been widely used in samples of novice nurses (Adamson, 2012; Alfes, 2011; Andrighetti, Knestrick, Marowitz, Martin, & Engstrom, 2012; Butler, Veltre, & Brady, 2009; Foster, Sheriff, & Cheney, 2008; Hensel,

Kathman, Hendricks, & Ball, 2012; Hoadley, 2009; Wang, Fitzpatrick, & Petrini, 2013; Zulkosky, 2012). But, little is known about the reliability and validity of the SCLS.

Importantly, part of this body of research entails quantifying the psychometric properties of the SCLS along with two other self-report simulation evaluation measures put forth by the NLN. For these psychometric analyses, a sample of 2,200 surveys completed by pre-licensure novice nurses was used; results are presented in Chapter III.

Expert Modeling

Healthcare professionals and educators from medicine (Zhang & Chawla, 2012), nursing (Aronson, Glynn, & Squires, 2013; Guhde, 2010; Johnson et al., 2012; LeFlore et al., 2007; McConville & Lane, 2006), dentistry (Nikzad, Azari, Mahgoli, & Akhoundi, 2012) and allied health (de Godoy, Costa Mendes, Hayashida, Noguiera, & Marchi Alves, 2004; Selle et al., 2008) report that expert modeling videos are useful as a teaching strategy because the video model becomes a standard of reference for future practice and thus deepens learning (Anderson et al., 2008). Expert modeling videos in nursing education provide exemplars of technical, behavioral, and cognitive skills demonstrated by an expert in the context of a specific patient (LeFlore et al.). Recent research has investigated whether or not expert modeling videos increase competence among novice healthcare providers (Aronson et al.; Johnson et al.; LeFlore et al.; McConville & Lane). A recent multi-site study found that expert modeling videos had a favorable impact on novice nurses' competence for providing care to a geriatric perioperative patient in simulation (Johnson et al.). Similarly, expert modeling videos have improved novice nurses' competence for performing physical assessment in traditional hospital-based

clinical experiences (Guhde, 2010). Thus, using a pre-simulation expert modeling video may be one way to increase novice nurses' competence in simulation and consequently in actual practice.

We anticipated pre-simulation expert modeling videos would increase novice nurses' competence, and we extended what is known from previous research by exploring the relationship between competence (Chapter IV) and self-efficacy (Chapter V). Several education studies have investigated the relationship between self-efficacy and academic performance (Brown, Lent, & Larkin, 1989; Huamao, Ying, & Ronghuai, 2006; Nie, Lau, & Liao, 2011), but nurse researchers have not yet identified a relationship between competence and self-efficacy or described factors that contribute to it. We explored the correlation between change in competence and self-efficacy in Chapter VI.

Conceptual Model

This body of research has foundations in Social Cognitive Theory, which contends that self-efficacy is the foundation of human agency (Bandura, 1986). Self-efficacy and confidence are often used interchangeably, however Bandura (1977) argued that self-efficacy is specific to a belief about a particular goal whereas confidence is a nonspecific term that broadly refers to belief in one's self. Much of the nursing education literature uses the term confidence, but we have chosen to use the term self-efficacy to better align with Bandura's conceptual framework. Social Cognitive Theory defines four sources of self-efficacy, specifically performance accomplishments, vicarious experience, social persuasion, and physiologic/emotional stress (Bandura, 1977). Bandura (2001) theorized that humans can overcome distress through the positive influence of self-

efficacy. Furthermore, self-efficacy dictates many facets of life — thinking, motivation, and decision-making (Rutherford-Hemming, 2012) — therefore self-efficacy can affect competence in a performed behavior (**Figure 1.1**).

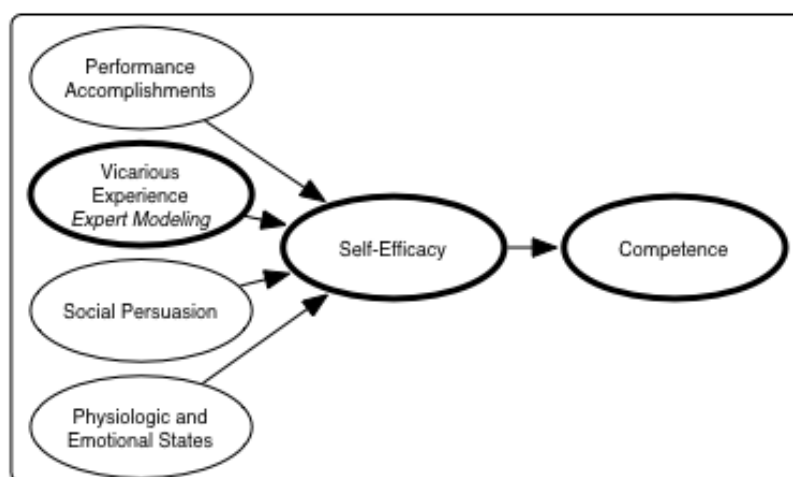


Figure 1.1. Sources of self-efficacy and influence of self-efficacy on competence according to Social Cognitive Theory.

Social Cognitive Theory calls for continuous interaction between an individual's behavior, cognition, and environment (Bandura, 1977). These three elements of Social Cognitive Theory (**Figure 1.2**) come to life in simulation, where the scenario, nursing behaviors, and clinical judgment also have continuous interaction. Thus, using Social Cognitive Theory as a framework for simulation research provides a deep, multi-dimensional environment where novice nurses can apply previous learning (Sinclair & Ferguson, 2009).

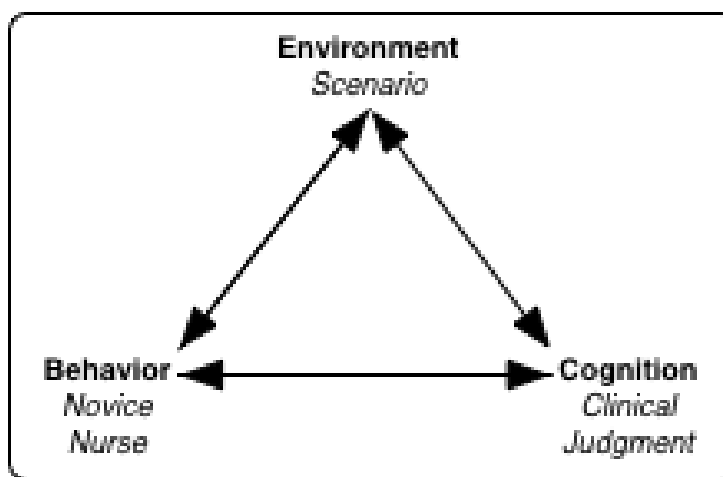


Figure 1.2. Interrelationship among central concepts represented by Bandura's Social Cognitive Theory. In simulation, the scenario represents the *environment*, novice nurses' interventions represent the *behavior*, and clinical judgment represents *cognition*.

Purpose and Specific Aims

This body of research fills important knowledge gaps related to our understanding of the influence of simulation preparation on novice nurses' competence and self-efficacy by using a series of quantitative analysis. There were five specific aims (**Table 1.1**). The first aim was to synthesize what is known about the influence of simulation on self-efficacy. To address this aim, a detailed review and random-effects meta-analysis of 43 published studies reporting the influence of simulation on self-efficacy was performed. A meta-analysis is integral to this body of research because it quantitatively synthesizes the known effects of simulation on self-efficacy, highlights research designs that are more fruitful in quantifying outcomes of simulation, and empowers researchers to investigate how interventions, such as expert modeling videos used as simulation preparation, further influence self-efficacy.

The second aim was to quantify the psychometric properties of three NLN simulation evaluation scales. As outlined in Chapter III, a robust psychometric analysis — including item reliability, concordant and discordant validity, discrimination, and exploratory and confirmatory factor analysis — was performed. This analysis is critically important because these tools are widely used in nursing simulation research, though there was previously little evidence to support reliability and validity.

Specific Aim	Title of Paper for How Aim Was Addressed
1) Synthesize what is known about the influence of simulation on self-efficacy. <i>Hypothesis: Simulation increases self-efficacy.</i>	Chapter II: Effectiveness of Simulation for Improvement in Self-Efficacy Among Novice Nurses: A Meta-Analysis
2) Quantify the psychometric properties of three NLN simulation evaluation scales using reliability and validity testing. <i>Hypothesis: All three scales have sufficient reliability and validity to be widely used in education research.</i>	Chapter III: Psychometric Testing on the NLN Student Satisfaction and Self-Confidence in Learning, Simulation Design Scale, and Educational Practices Questionnaire Using a Sample of Pre-Licensure Novice Nurses
3) Compare the efficacy of expert modeling videos with voice over PowerPoint and reading assignments on novice nurses' competence for providing care to multiple patients in simulation. <i>Hypothesis: Novice nurses in the expert modeling group will demonstrate greater improvement in competence for providing care to multiple patients than novice nurses in the active and passive control groups.</i>	Chapter IV: Comparison of Expert Modeling Versus Voice Over PowerPoint and Pre-Simulation Readings on Novice Nurses' Competence for Providing Care to Multiple Patients
4) Compare the efficacy of expert modeling videos with voice over PowerPoint and reading assignments on novice nurses' self-efficacy for providing care to multiple patients in simulation. <i>Hypothesis: Novice nurses in the expert modeling group will report greater improvement in self-efficacy for providing care to multiple patients than novice nurses in the active and passive control groups.</i>	Chapter V: Effectiveness of an Expert Modeling Intervention on Novice Nurses' Self-Efficacy in Multiple Patient Simulation
5) Explore the relationship between competence and self-efficacy after multiple patient simulation. <i>Hypothesis: Change in competence will be associated with change in self-efficacy.</i>	Chapter VI: Association of Change in Competence and Self-Efficacy After a Multiple Patient Simulation RCT

Table 1.1 Specific Aims and How Each Was Addressed.

The third aim was to compare the efficacy of expert modeling videos with voice over PowerPoint and traditional reading assignments on novice nurses' competence for providing care to multiple patients. This aim was the first tested with an innovative three-group randomized control trial that is described in detail in Chapter IV. In brief, the

hypothesis that novice nurses in the expert modeling group would demonstrate greater improvement in competence for providing care to multiple patients than novice nurses in the voice over PowerPoint (active control) and reading assignment (passive control) groups was tested.

The fourth aim of this body of research was to compare the efficacy of expert modeling versus active and passive controls on novice nurses' self-efficacy for providing care to multiple patients. The expected finding was that the expert modeling group would report increased self-efficacy compared to the active control group, which would report increased self-efficacy compared to the passive control group. These findings are important because knowledge from Social Cognitive Theory (Bandura, 1977) and novice nurses' self-report confirms that low self-efficacy limits competence in actual nursing practice. Thus, findings from this body of research help researchers understand how interventions to increase novice nurses' self-efficacy can help to increase their competence; additionally, this finding represents the first step in uncovering how increased self-efficacy and competence may be a means of decreasing errors in actual nursing practice. The quantitative analysis addressing aim four is presented in Chapter V.

The fifth aim of this body of research, reported in Chapter VI, was to explore the relationship between change in competence and self-efficacy after multiple patient simulation. Self-efficacy and competence in response to simulation are often assumed to be related; but, this relationship is seldom quantified.

Summary

This body of research was the first to examine how various simulation preparation methods enhance novice nurses' competence and increase self-efficacy, thereby filling an important gap in the knowledge about simulation. The quantitative synthesis of the relationship between simulation and self-efficacy provides a clear recommendation that researchers should not measure self-efficacy as an exclusive outcome of simulation research. The results of this body of research provide evidence that supports expert modeling and voice over PowerPoint used in lieu of reading assignments as simulation preparation. In doing so, this body of research supports a change in practice for nurse educators facilitating simulation in academic and practice settings.

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Chapter II — EFFECTIVENESS OF SIMULATION FOR IMPROVEMENT IN SELF-EFFICACY AMONG NOVICE NURSES: A META-ANALYSIS

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This manuscript represents a significant contribution that in many ways exceeds the scope of predoctoral nursing research and replaces aspects of traditional literature review, methods and results chapters. Ashley Franklin was the primary author on this paper and conducted the analysis under the direction of Dr. Lee during her tenure at OHSU; Dr. Lee was the senior author on this paper. This paper was accepted by *Journal of Nursing Education* (impact factor 1.133), an indexed and peer-reviewed journal with a larger readership of those interested in nursing education, as a major article.

Because the unit of analysis was self-efficacy data that had been previously published and was therefore unidentifiable, our Institutional Review Board reviewed this study as being exempt on the basis that it is not human subject research.

Abstract

Background: The influence of simulation on self-efficacy for novice nurses has been reported inconsistently in the literature.

Methods: Effect sizes across studies were synthesized using random-effects meta-analysis.

Results: Simulation improved self-efficacy in one group, pre-posttest studies (Hedge's $g = 1.21$ (95% CI 0.63 to 1.78); $p < 0.001$). Simulation also was favored over control teaching interventions in improving self-efficacy in studies with experimental designs (Hedge's $g = 0.27$ (95% CI 0.1 to 0.44); $p = 0.002$). In non-experimental designs, consistent conclusions about the influence of simulation were tempered by significant between-study differences in effects.

Conclusions: Simulation is effective at increasing self-efficacy among novice nurses compared with traditional control groups.

Introduction

Self-efficacy — a general sense of effectiveness (Smith, 1989) wherein one perceives they are capable of performing in a certain manner to achieve specific goals (Bandura, 1977) — influences virtually every aspect of a nurse's practice, including the ability to think optimistically, persevere through difficulties, and ultimately complete tasks (Bandura, 1977; Pajares, 2002). As nurses progress through undergraduate coursework and the first six months of work experience (i.e. novice nurses; Benner, Tanner, & Chesla, 2009), their self-efficacy and relative perception of success in clinical courses is critical to advancement (Tanner, 2006). Furthermore, novice nurses with high self-efficacy have a firmer commitment to use their clinical skills, a better chance of meeting their clinical goals (Clark, Owen, & Tholcken, 2004), and they overcome stressful situations more easily.

Bandura reported that high self-efficacy in one situation tends to generalize to other situations where an individual may have perceived themselves as having personal inadequacy during a previous experience (Bandura, Jeffrey, & Gajdos, 1975). Perhaps generalizability is one reason why nurse educators have adopted self-efficacy as an outcome of simulation education. Broadly, nurse educators have an inherent interest in seeing simulation outcomes transfer to other situations of actual nursing practice.

The active learning component of simulation fits naturally with Bandura's Social Cognitive Theory. Bandura (1977) identified experiences that increase self-efficacy based on outcomes from his program of research; he theorized that mastery of new skills and experiencing success during performance have the strongest influence on self-efficacy.

Nurse educators who extend Bandura's framework to simulation relate increases in self-efficacy to simulation features including hands-on practice, immediate feedback, peer modeling (Lundberg, 2008) and repeated practice in a psychologically safe environment.

Recently, there has been critique of the exclusive study of self-efficacy in the literature from both nurse and physician educators who express concern about the gap between self-efficacy and competent behavioral performance (Baxter & Norman, 2011; Calhoun, Rider, Meyer, Lamiani, & Truog, 2009; Kardong-Edgren, 2013; Liaw, Sherpbier, Rethans, & Klainin-Yobas, 2012). Interestingly, Bandura (1977) addressed some of these concerns through cognitive psychology research, where he related that ambiguity in the context of a particular situation, capabilities, and/or motivation of participants could be associated with discrepancies between self-efficacy and behavioral performance. Bandura's theoretical framework also provides insight into sources of self-efficacy and factors that might predict how self-efficacy corresponds with behavioral performance, which are valuable to consider before discounting self-efficacy as an important outcome of simulation.

In nursing education, researchers have examined the effect of simulation on self-efficacy primarily through small studies and in unique contexts. Thus, there is a gap in the literature related to quantitative synthesis of the impact of simulation on improving novice nurses' self-efficacy. While systematic reviews provide insight into the "How" and the "Why" of simulation effectiveness (Cant & Cooper, 2010), the question of "What" the impact of simulation self-efficacy is still remains. A quantitative synthesis of evidence regarding the effectiveness of simulation and key research design features that

support the investigation of simulation's effect of self-efficacy will aid nurse researchers' decision-making and highlight future research opportunities. Specifically, measuring the overall effect of simulation on self-efficacy with a meta-analysis helps us understand the appropriateness of measuring self-efficacy alongside behavioral performance and other outcomes of simulation.

The current meta-analysis makes an important contribution to the field by providing an overall estimate of the effect of simulation on self-efficacy for novice nurses. In the last three years, meta-analytic techniques have been used to examine simulation outcomes for broad topics like knowledge, skills and behaviors (Cook et al., 2011; Ilgen, Sherbino, & Cook, 2013; Kennedy, Maldonado, & Cook, 2013; Lorello, Cook, Johnson, & Brydges, 2013; Mundell, Kennedy, Szostek, & Cook, 2013) with mixed groups of healthcare providers; but, self-efficacy with novice nurses has not been synthesized. Accordingly, the purpose of this study was to quantitatively synthesize the self-efficacy outcomes of simulation among novice nurses.

Methods

We conducted this meta-analysis in adherence to PRISMA standards of quality for reporting meta-analysis (Moher, Liberati, Tetzlaff, & Altman, 2009).

Study Question

We sought to answer the question, "What is the impact of simulation on self-efficacy?"

Study Eligibility

Published intervention studies were identified using PubMed, CINAHL, and Medline with a combination of MeSH terms including “education, nursing,” “self-efficacy,” “self-concept,” “confidence,” “nursing education research,” and “patient simulation.” Nursing literature uses “self-efficacy,” “self-concept” and “confidence” interchangeably. The concepts are related, but they have different defining attributes because self-concept and confidence represent personal characteristics that have a stable influence on behavior while self-efficacy represents a temporary characteristic tied to a specific situation (Zulkosky, 2009). To accommodate interchangeable language, reference lists were searched to identify additional studies of simulation and novice nurse self-efficacy. One researcher used a double entry verification process for extraction from the source to database to ensure consistency. Experimental and non-experimental designs were included. We did not use a beginning cutoff date, and the last date of the search was January 15, 2014. Inclusion criteria were: Novice nurses, simulation interventions, and self-efficacy outcomes. For the purpose of this work, we defined novice nurses as individuals who lack real-world experience in their role, such that their practice could be characterized by rule-based thinking (Benner et al., 2009); therefore novice undergraduate nurses, new graduate nurses, and novice advanced practice nurses were included in this analysis.

Because the unit of analysis was self-efficacy data that had been previously published and was therefore unidentifiable, our Institutional Review Board reviewed this study as being exempt on the basis that it is not human subject research.

Statistical Analysis

We extracted, verified, and combined raw data into a single database. Specifically, we extracted two types of effect sizes from the literature. First, we retained point estimates of self-efficacy. From studies with a one group posttest only design, point estimates represented the proportion of participants who “Agree” or “Strongly Agree” to statements that simulation increased their self-efficacy. Second, from studies with a two group posttest only, one group pre- and posttest, and two group pre- and posttest design, we extracted point estimates of means and standard deviations and calculated mean change and the variance of the mean change where appropriate. We kept mean changes in the original metric of the self-efficacy measures for interpretability and used standardized mean differences (Hedge’s g) to account for potential overestimation with small samples (Hedges, 1984). Hedge’s g and the more familiar Cohen’s d convey information about effect size (<0.49 = small, $0.5-0.8$ = moderate, >0.81 = large; Cohen, 1988; Hedges & Olkin, 1985).

We performed random-effects meta-analyses to quantify pooled effectiveness estimates, taking into account both within-study variance and between-study heterogeneity (Kontopantelis & Reeves, 2010). We weighted studies by the inverse of within-study variance plus the between-study heterogeneity as calculated by the DerSimonian and Laird method (DerSimonian & Laird, 1986); in brief, small and imprecise studies are given less weight and large and more precise studies are given more weight in the calculation of the overall estimate. This manuscript reports both weighted pooled effectiveness estimates and 95% confidence interval (CI). We also included z -

tests (weighted estimate divided by the standard error of the weighted estimate) and associated p-values (testing against the null hypothesis of neutral effectiveness) for each measure to represent the precision of the pooled estimate across studies.

For each analysis, we also quantified heterogeneity and performed tests of bias in our estimation. Regarding heterogeneity, we calculated total dispersion in effect sizes (Q) and the associated p-value. In the event of significant heterogeneity, we also used I^2 to quantify variation in observed effectiveness estimates across studies; I^2 ranges from 0% (indicating that all of the heterogeneity is spurious) to 100% (indicating that all of the heterogeneity is “real” and requires further examination/explanation). In general, I^2 values greater than 50% indicate excessive heterogeneity (Higgins, Thompson, Deeks, & Altman, 2003); but, we also used formal significance testing to see if heterogeneity was significantly far away from zero. We assessed small study bias graphically and with Egger’s test (Egger, Davey Smith, Schneider, & Minder, 1997). We used Duval and Tweedie’s trim and fill in cases of asymmetry (Duval & Tweedie, 2000). We explored sources of excessive heterogeneity with pre-determined subgroup analyses according to publication year, sample characteristics (academic degree), comparison interventions, dose of simulation (one scenario or multiple), and self-efficacy measurement tools (previously validated or not). Finally, Orwin’s fail-safe N was calculated as an estimate of publication bias. We used Comprehensive Meta-Analysis 2.2 (Englewood, New Jersey, USA) and StataMP 13 (College Station, Texas, USA) for analysis.

Results

Trial Flow

We identified 811 potentially relevant manuscripts, 738 using the search strategy and 73 from the review of reference lists. From these, we retained 43 studies out of 38 unique manuscripts (**Figure 2.1**) that enrolled 3,500 novice nurses. Of the 38 manuscripts, 33 included samples of novice undergraduate nurses (Abdo & Ravert, 2006; Adamson, 2012; Alfes, 2011; Alinier, Hunt, Gordon, & Harwood, 2006; Bambini, Washburn, & Perkins, 2009; Baxter & Norman, 2011; Blum, Borglund, & Parcells, 2010; Brannan, White, & Bezanson, 2008; Bremner, Aduddell, Bennett, & VanGeest, 2006; Butler & Veltre, 2009; Buykx et al., 2011; Cardoza & Hood, 2012; Dearmon et al., 2013; Dykes, 2011; Feingold, Calaluce, & Kallen, 2004; Foster, Sheriff, & Cheney, 2008; Howard, 2007; Johnson et al., 2012; Kaplan & Ura, 2010; Kiat, Mei, Nagammal, & Jonnie, 2007; Lambton, O'Neill, & Dudum, 2008; Leigh, 2008; Liaw et al., 2012; McCaughey & Traynor, 2010; Morrison, Scarcello, Thibeault, & Walker, 2009; Mould, White, & Gallagher, 2011; Prescott & Garside, 2009; Reinhardt, Mullins, De Blicck, & Schultz, 2012; Rockstraw, 2006; Traynor, Gallagher, Martin, & Smyth, 2010; Wang, Fitzpatrick, & Petrini, 2013; White, Brannan, Long, & Kurszka, 2013; Zulkosky, 2012); an additional 4 included samples of novice advanced practice nurses (Andrighetti, Knestrick, Marowitz, Martin, & Engstrom, 2012; LeFlore, Anderson, Michael, Engle, & Anderson, 2007; Scherer, Bruce, & Runkawatt, 2007; Tiffen, Graf, & Corbridge, 2009). One more manuscript included samples of new graduate nurses (Beyea, Slattery, & von Reyn, 2010).

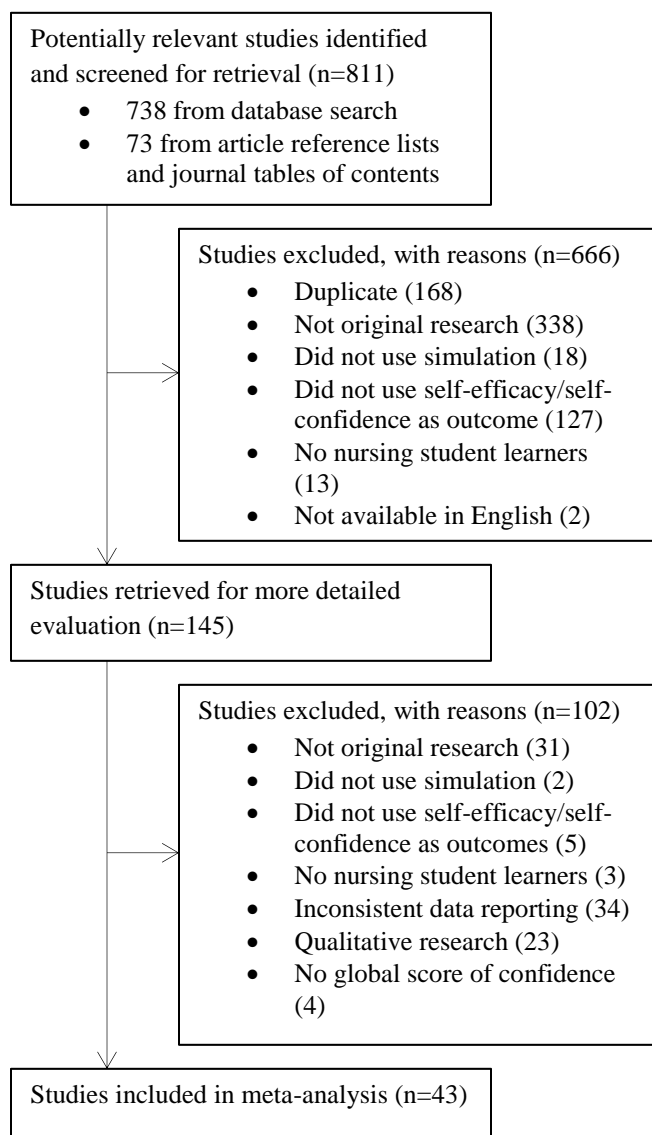


Figure 2.1. Meta-Analysis: Trial Flow.

Study Characteristics

We identified studies published between 2004 and 2013 that investigated novice nurses' self-efficacy after simulation, where simulation was in the context of nursing care for adult and pediatric patients. Eleven studies involved adult critical care patients, six

involved fundamental skills and assessment, and four involved non-technical skills such as communication, priority setting, and delegation. The remainder of studies focused on a variety of nursing care topics.

A majority of studies involved mannequin simulations (n=34). Twenty-two of those involved high-fidelity mannequins, and five involved medium to high-fidelity. For six studies, we could not determine the type of mannequin used in simulation. One study involved a combination of mannequins with different levels of fidelity. Five studies used Standardized Patient actors. Two studies used Standardized Patient actors as family members in simulation, and an additional two studies used Standardized Patient actors exclusively. One study used a Standardized Patient actor as a comparison group.

Seven studies compared simulation to lecture. Three studies compared simulation to case study. Three studies compared mannequin simulation to computer-based simulation. Two studies compared simulation to task trainers. One compared simulation with a high-fidelity mannequin to a low fidelity mannequin. Other comparison groups used in single studies included Standardized Patient actors, skills lab, and different types of simulation preparation.

Most studies described a “dose” of simulation as one or two simulation experiences, though five studies evaluated programs of simulation that spanned the length of an academic semester. Generally, the effect size of simulation’s influence on self-efficacy in each study was small, but that does not mean that it is not relevant to educational or clinical goals.

One Group, Posttest Only Design

Twelve studies reported self-efficacy outcomes using a posttest only design without a comparison group (Abdo & Ravert, 2006; Bremner et al., 2006; Feingold et al., 2004; Foster et al., 2008; Kaplan & Ura, 2010; Kiat et al., 2007; Lambton et al., 2008; McCaughey & Traynor, 2010; Morrison et al., 2009; Mould et al., 2011; Prescott & Garside, 2009; Traynor et al., 2010). All studies used a Likert-style scale and reported the percentage of participants who responded with “Agree” or “Strongly Agree” to prompts related to self-efficacy. Ten of the scales were faculty-developed, and the remaining two scales were previously published. Based on the raw results, 11 of the 12 favored simulation. In meta-analysis, 86.9% of respondents indicated that simulation improved self-efficacy (**Figure 2.2, Table 2.1**). Given the asymmetry in effectiveness across studies, we used Duval and Tweedie’s trim and fill to generate a lower and less biased effect size (82.8%) after trimming three studies. There was minimal concern for small sample or publication bias.

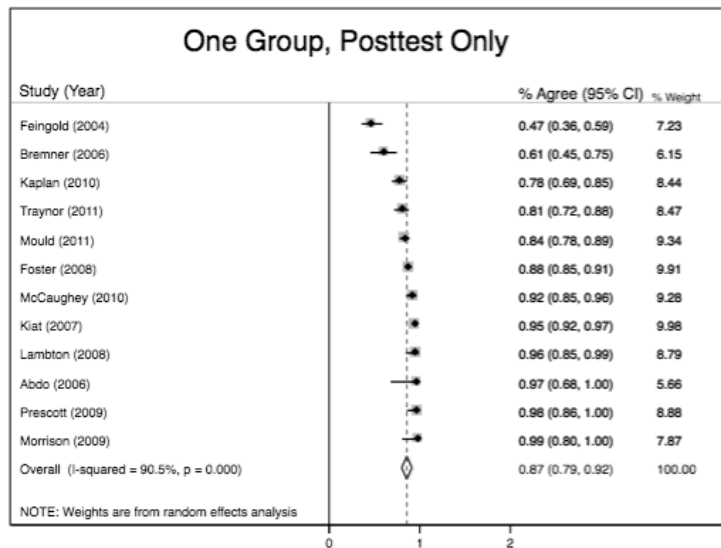


Figure 2.2. Meta-analysis: One group, posttest only (n=12). Positive numbers indicate participants “Agree” or “Strongly Agree” that simulation increased their self-efficacy.

Study Characteristics			Random Effects Results				Heterogeneity Statistics			Sources of Bias		
Number of Studies	N	%/ Hedge's <i>g</i>	95% CI	<i>z</i>	p-value	<i>Q</i>	<i>I</i> ²	p-value	Subgroup analysis	Egger's test	Fail-safe N	
One group, posttest only	12	1376	86.9%	78.5-92.4	6.17	<0.001	115.52	90.5%	<0.001	NS	0.42	21
Two group, posttest only	11	818	0.004	-0.37-0.379	0.02	0.982	64.88	84.6%	<0.001	NS	0.999	NA
One group, pre and posttest	9	767	1.205	0.629-1.78	4.11	<0.001	108.11	92.6%	<0.001	NS	0.628	10
Two group, pre and posttest	11	539	0.271	0.101-0.442	3.118	0.002	7.86	0.0%	0.643	NA	0.33	14

Table 2.1. Influence of Simulation on Novice Nurses' Self-Efficacy: Random Effects Meta-Analysis.

NA = not applicable, NS = not significant.

Two Group, Posttest Only Design

Eleven studies, from nine unique manuscripts, reported self-efficacy outcomes using a two group, posttest only design (Alfes, 2011; Alinier et al., 2006; Butler et al., 2009; Howard, 2007; Johnson et al., 2012; Reinhardt et al., 2012; Tiffen et al. 2009; Wang et al., 2013; Zulkosky, 2012). Six studies favored simulation, and five studies indicated simulation had negative effects on self-efficacy. In the meta-analysis, the summary effect in Hedge's g was 0.004 (**Figure 2.3, Table 2.1**). The summary estimate was imprecise and non-significant; subgroup analysis (by publication year, academic degree, comparison interventions, dose of simulation, and self-efficacy measurement tools) did not significantly change the pooled estimate or decrease heterogeneity (exceeded 84%). Small sample bias was minimal.

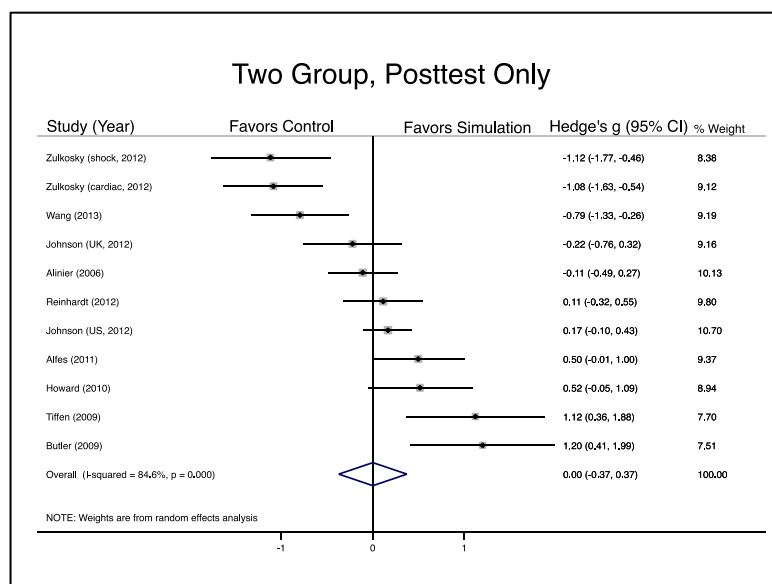


Figure 2.3. Meta-analysis: Two group, posttest only (n=11). Positive numbers favor simulation. Studies are classified according to type of scenario and location, where necessary. UK, United Kingdom; US, United States.

One Group, Pre- and Posttest Design

Nine studies, from eight unique manuscripts, reported self-efficacy outcomes using a pre- and posttest design without a comparison group (Bambini et al., 2009; Baxter & Norman, 2011; Beyea et al., 2010; Buykx et al., 2011; Cardoza & Hood, 2012; Dearmon et al., 2013; Leigh, 2008; Mould et al., 2011). Seven studies favored self-efficacy after simulation, and two favored self-efficacy before simulation. In the meta-analysis, the summary effect in Hedge's g was 1.205 (Figure 2.4, Table 2.1). Subgroup analysis by dose of simulation did not significantly change the pooled estimate or decrease heterogeneity. Duval and Tweedie's trim and fill provided an improved effect size (1.24) after trimming one study to balance asymmetry in effects. Small study and publication bias was minimal.

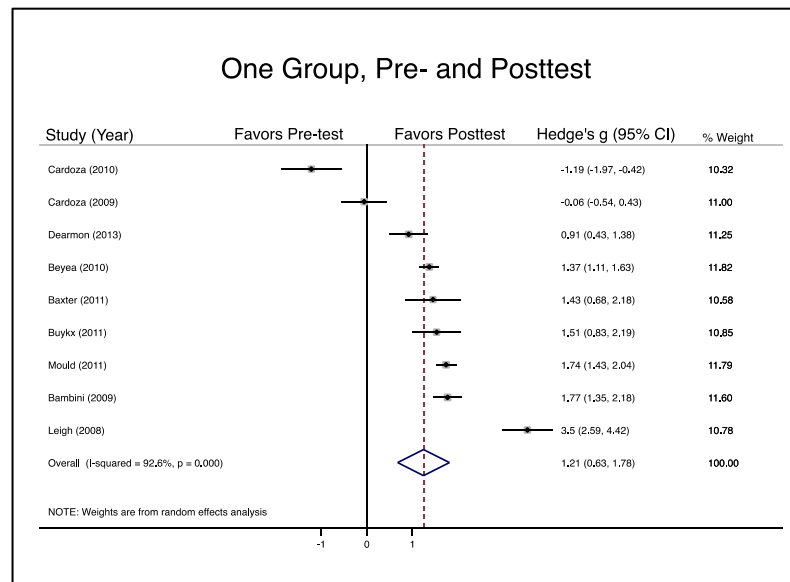


Figure 2.4. Meta-analysis: One group, pre- and posttest (n=9). Positive numbers favor posttest self-efficacy scores.

Two Group, Pre- and Posttest Design

Eleven studies reported self-efficacy outcomes using a two group, pre- and posttest design (Adamson, 2012; Alfes, 2011; Andrighetti et al., 2012; Blum et al., 2010; Brannan et al., 2008; Dykes, 2011; LeFlore et al., 2007; Liaw et al., 2012; Rockstraw, 2006; Scherer et al., 2007; White et al., 2013); five of the 11 used a randomized trial design. All studies favored simulation over control. In the meta-analysis, the summary effect in Hedge's g was 0.271 and significant (**Figure 2.5, Table 2.1**). Effects were symmetric, thus, Duval and Tweedie's trim and fill did not change our summary estimate. There was minimal concern for small sample or publication bias.

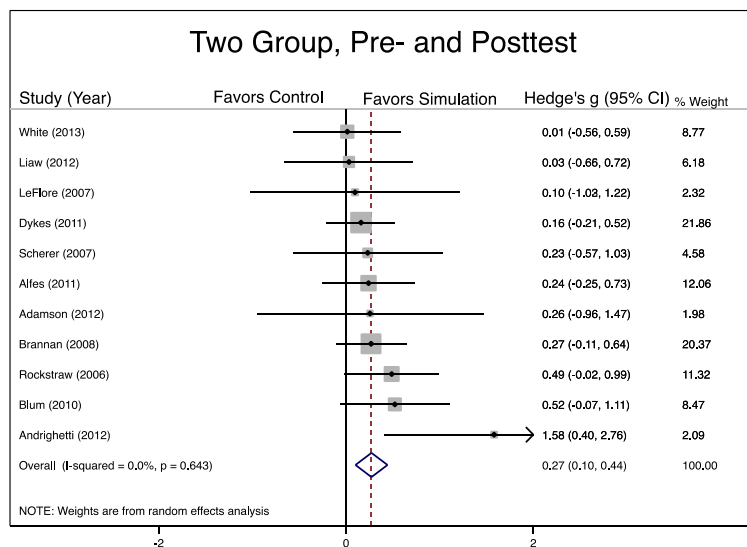


Figure 2.5. Meta-analysis: Two group, pre-and posttest (n=11). Positive numbers favor simulation.

Discussion

We performed random-effects meta-analysis on the results of 43 studies to quantify the influence of simulation on the self-efficacy among 3,500 novice nurses.

Despite variability in effects within studies and heterogeneity in effects between studies, we observed that the vast majority of novice nurses agree that simulation increases self-efficacy, and that self-efficacy is greater after simulation compared with pre-simulation evaluation. We also observed that simulation is associated with greater improvements in self-efficacy compared with controls. These findings are significant as they represent the first quantitative synthesis of novice nurses' self-efficacy outcomes associated with simulation. Most importantly, simulation-based training was effective in increasing self-efficacy compared with traditional didactic lecture across studies using experimental designs. An additional finding is that methodological issues — including differences in control conditions, participant characteristics, measures, and simulation context — interfere with statistical conclusions about the relationship between simulation and self-efficacy from studies with non-experimental designs. Although we employed a meta-analytic technique designed to incorporate between-study differences, significant heterogeneity decreases the precision of our summary estimates.

Sources of Heterogeneity

In our analysis, control conditions likely contributed to conclusions of equipoise in studies using a two group, posttest only design. On one hand, a majority of two group studies compared simulation — an active, experiential learning strategy — to didactic lecture or other less-engaging control conditions. Such comparisons intuitively impact novice nurses' self-efficacy differently, so we were not surprised by the positive relationship between participating in simulation and self-efficacy (Andrighetti et al., 2012; Wang et al., 2013). Alternatively, some researchers have reported increased self-

efficacy for both the simulation and control groups (Alfes, 2011; Alinier et al., 2006; Blum et al., 2010; Brannan et al., 2008; Dykes, 2011; Rockstraw, 2006). Thus, conclusions of equipoise may be related to diversity of control conditions.

Variety among characteristics of simulation participants was likely an additional cause of heterogeneity in our analyses. For example, male novice nurses and younger novice nurses report more self-efficacy (Mould et al., 2011). Furthermore, academic preparation of novice nurses may influence how simulation impacts self-efficacy. In studies that compare self-efficacy after simulation versus lecture, data from baccalaureate novice nurses favored lecture over simulation (Zulkosky, 2012) while data from advanced practice novice nurses favored simulation over lecture (LeFlore et al., 2007). One potential explanation is that novice nurses may overestimate their ability and have inflated self-efficacy before a simulation, which decreases after real-life simulation learning experiences (LeFlore et al., 2007). Such between-study variety of simulation participants across non-experimental studies may negatively affect simulation outcomes that can be synthesized using meta-analytic techniques.

Other sources of heterogeneity could relate to the context in which simulation and control conditions take place. For example, novice nurses reported increased self-efficacy for physical assessment skills after simulation (Tiffen et al., 2009). However, similar samples of novice nurses reported no change in self-efficacy for intravenous catheter insertion (Reinhardt et al., 2012) or other skills that they have previously mastered (Bambini et al., 2009). Thus, it seems self-efficacy after simulation may depend on the context of simulation. It could be that novice nurses report lower self-

efficacy for performing psychomotor skills after simulation because simulation commonly encompasses cognitive, affective, psychomotor, and behavioral domains of learning.

Regardless of the source, significant heterogeneity decreases our precision in the estimate of a summary effect. In this meta-analysis, heterogeneity interfered with our estimate of the effect of simulation with three non-experimental designs. First, using a one group, posttest only design, the vast majority of nurses (86.9% trimmed to 82.8%) agree that simulation improves self-efficacy. But, there were considerable differences between studies that likely influence our best estimate. Second, using a one group, pre- and posttest design, our best guess is that simulation has a large impact on self-efficacy for novice nurses. Again, considerable differences between studies impair our ability to generate more precise estimates of this effect. Third, and more impressively, there were so many differences between studies in our analysis of two-group, posttest only designs that we could not generate a precise estimate and our best guess was that there was no difference in simulation training on novice nurses' self-efficacy. Our attempts to balance asymmetry, account for small sample bias, and perform subgroup analysis did not reduce the extent of between-study differences.

Diversity of Self-Efficacy Tools

Twenty-one out of 43 studies included in this review used previously unvalidated tools, many of which were faculty-developed. While it is common for nurse educators to use faculty-developed tools in simulation teaching, the use of such tools in research significantly limits conclusions. Specifically, researchers using unvalidated tools take a

risk in measuring a different latent construct than intended (e.g. motivation instead of self-efficacy). Without validity evidence for self-efficacy tools used with novice nurses in simulation, it is difficult to know if the measures are useful.

Nine studies included in this analysis used the Student Satisfaction and Self-Confidence in Learning tool put forth by the National League for Nursing (Jeffries & Rizzolo, 2006). Though many educators use the tool in teaching, one significant limitation is that there is not advanced psychometric data to support its use. Cronbach's alpha is helpful to understand internal consistency of the tool, but there are other psychometric properties such as factor loadings as well as concordant and discordant validity that are critically needed. Thus, conclusions made about self-efficacy outcomes using tools without psychometric support contribute to between-study heterogeneity and limit our confidence in conclusions from this meta-analysis.

Strengths and Limitations

Beyond general criticisms of meta-analysis, there are a few limitations that are important to consider when evaluating the significance of these findings. First, measurement errors — including lack of reliability testing — are common in nursing education research. Further, lack of a uniform measure of self-efficacy limits our understanding of the magnitude and direction of simulation's effect on self-efficacy among novice nurses. Despite this limitation, our estimate of the impact of simulation using a standard mean difference (Hedge's g) minimizes bias from measurement error in individual studies. Another limitation is that we selected manuscripts that had been previously published to use in this meta-analysis. As such, there is a possibility that our

estimate of the effect of simulation on novice nurses' self-efficacy could be adjusted with inclusion of unpublished work, especially given that researchers are more likely to publish studies with significant findings. Despite this limitation, we used robust estimations of the number of unpublished studies required to make our findings non-significant.

Recommendations and Conclusion

This study adds new knowledge about the overall impact of simulation on self-efficacy for novice nurse participants using robust statistical techniques that provide a foundation for measuring self-efficacy moving forward. We have three formal recommendations, which reflect our interest in moving forward the science of simulation research. First, it is imperative that researchers use previously validated self-efficacy tools and not create their own, as this is unnecessary and contributes to an inability to synthesize the relationship between simulation and self-efficacy. The National League for Nursing Student Satisfaction and Self-Confidence in Learning tool has been used with success in simulation research thus far, though evidence of reliability and validity has yet to be published. Second, the only way to advance the science is to use experimental methods to compare the effect of simulation versus another teaching strategy. Our clearest signal of the influence of simulation on self-efficacy came from our analyses of experimental studies. Researchers should not do comparison studies without using an experimental design, because there is too much diversity among the study design, control conditions, participants, and simulation context to make conclusions about the relationship between simulation and self-efficacy. Further,

measuring the effect of simulation without a comparison intervention seems like a biased research design. Third, we need to move beyond using self-efficacy as a stand-alone outcome of simulation. Our meta-analysis represents a clear relationship between simulation and increased self-efficacy for novice nurses. As such, there is no longer a need to measure self-efficacy as an exclusive simulation outcome. Alternatively, it seems appropriate to combine self-efficacy with other dependent variables (such as behavioral performance) and measure changes in self-efficacy with changes in other variables of interest.

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Chapter III — PSYCHOMETRIC TESTING ON THE NLN STUDENT
SATISFACTION AND SELF-CONFIDENCE IN LEARNING, SIMULATION
DESIGN SCALE, AND EDUCATIONAL PRACTICES QUESTIONNAIRE USING A
SAMPLE OF PRE-LICENSURE NOVICE NURSES

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This manuscript represents a significant contribution that in many ways exceeds the scope of predoctoral nursing research and replaces aspects of traditional methods and results chapters. Ashley Franklin was the primary author on this paper and conducted the analysis under the direction of Dr. Lee during her tenure at OHSU. Dr. Burns supervised data collection; Dr. Lee was the senior author on this paper. This paper was submitted to *Nurse Education Today* (impact factor 1.218), an indexed and peer-reviewed journal with an international readership of those interested in nursing education, as a full length research report.

The Institutional Review Board determined that this study was not human subject research.

Abstract

Background: In 2006, the National League for Nursing published three measures related to novice nurses' beliefs about self-confidence, scenario design, and educational practices associated with simulation. Despite the extensive use of these measures, little is known about their reliability and validity.

Methods: The psychometric properties of the Student Satisfaction and Self-Confidence in Learning scale, Simulation Design Scale, and Educational Practices Questionnaire were studied among a sample of 2200 surveys completed by novice nurses from a liberal arts university in the southern United States. Psychometric tests included item analysis, confirmatory and exploratory factor analyses in randomly-split subsamples, concordant and discordant validity, and internal consistency.

Results: All three measures have sufficient reliability and validity to be used in education research. There is room for improvement in content validity with the Student Satisfaction and Self-Confidence in Learning and Simulation Design Scale.

Conclusion: This work provides robust evidence to ensure that judgments made about self-confidence after simulation, simulation design and educational practices are valid and reliable.

Background

Since 2006, the National League for Nursing Student Satisfaction and Self-Confidence in Learning scale (SCLS), Simulation Design Scale (SDS), and Educational Practices Questionnaire (EPQ) have been widely used to measure novice nurses' beliefs and attitudes about learning in simulation (Adamson, 2012; Alfes, 2011; Andrighetti, Knestrick, Marowitz, Martin, & Engstrom, 2012; Butler, Veltre, & Brady, 2009; Foster, Sheriff, & Cheney, 2008; Lewis & Ciak, 2011; Parker et al., 2011; Smith & Roehrs, 2009; Swanson et al., 2011; Wang, Fitzpatrick, & Petrini, 2013; Zulkosky, 2012). Nurse educators have used the three measures in the contexts of teaching, assessment, and research, and data gathered with these measures has contributed to revisions of the Jeffries Simulation Framework (Jeffries, 2007). Yet, little is known about the psychometric properties of these measures.

Many stakeholders are interested in simulation outcomes. For example, educators are interested in simulation because it can influence both self-confidence and competent behavioral performance (Mould, White, & Gallagher, 2011; Reinhardt, Mullins, De Blicke, & Schultz, 2012; Shepherd, McCunnis, & Brown, 2010; Swanson et al., 2011). Nursing deans and other administrators are interested in simulation because it can be an alternative learning experience for novice nurses when traditional hospital-based experiences are not available (Parker et al., 2011). Hospital nurse leaders are also interested in simulation to bolster novice nurse residency programs and minimize the theory to practice gap (Beyea, Slattery, & von Reyn, 2010). Stakeholders of simulation can use the SCLS, SDS, and EPQ to measure learner-reported outcomes; but, the lack of

psychometric evidence of the reliability and validity of these measures raises concern about the soundness of their widespread use.

Accordingly, the purpose of this study was to establish the psychometric properties of the SCLS, SDS, and EPQ using reliability (in terms of item analysis, discrimination, and Cronbach's alpha) and validity testing (both confirmatory (CFA) and exploratory factor analysis (EFA), concordant and discordant validity).

Methods

Sample and Setting

The sample (N=2200) consisted of surveys completed by novice nurses in a pre-licensure baccalaureate nursing program at a liberal arts university in the southern United States. Participants were enrolled in either a traditional or accelerated baccalaureate nursing program. Inclusion criteria were 1) participation in simulation activities as part of regularly scheduled clinical coursework, and 2) age 18 years or older. Data were collected between 2007-2010 at one university following all simulations with novice nurse participants. Since anonymous data were used in this analysis, our Institutional Review Board determined that this study did not involve human subject research.

Measures

Student Satisfaction and Self-Confidence in Learning scale (SCLS). A total of 13 items assess the attitudes toward satisfaction with instruction and self-confidence in learning in simulation (Jeffries & Rizzolo, 2006). A "satisfaction with instruction" subscale contains five items measuring satisfaction with teaching methods, diversity of

learning materials, facilitation, motivation, and overall suitability of simulation. A “self-confidence with learning” subscale contains eight items measuring self-confidence in content mastery, content necessity, skills development, available resources, and knowledge of how to obtain help to solve clinical problems in simulation. For each item, participants indicated their personal feelings about a statement that described their own attitudes or beliefs. Response options were 1) *Strongly Disagree*, 2) *Disagree*, 3) *Undecided*, 4) *Agree*, and 5) *Strongly Agree* using a Likert-style scale (**Appendix A**). Cronbach’s alpha has been reported as 0.94 for the satisfaction subscale and 0.87 for self-confidence subscale (Jeffries & Rizzolo). Scores are calculated by summing responses; higher scores indicate more satisfaction and more self-confidence, respectively.

Simulation Design Scale (SDS). A total of 20 items assess perceptions of objectives, information, support, problem solving, feedback, and fidelity in simulation (Jeffries & Rizzolo, 2006). An “objectives and information” subscale contains five items measuring perceptions about the objectives, preparation materials, and cues provided during simulation. A “support” subscale contains four items measuring perceptions about need for support and provision of support during simulation. A “problem solving” subscale contains five items measuring facilitation and opportunities for problem solving during simulation. A “feedback” subscale contains four items measuring constructive feedback and opportunities for guided reflection. Finally, a “fidelity” subscale contains two items measuring real-life factors of the simulation. For each item, participants indicated their perceptions about a statement that described the presence of simulation

design features. Response options for statements related to presence of simulation design features were 1) *Strongly Disagree*, 2) *Disagree*, 3) *Undecided*, 4) *Agree*, 5) *Strongly Agree*, and NA) *Not Applicable* using a Likert-style scale (**Appendix B**). Cronbach's alpha has been reported as 0.92 for the presence of design features and 0.96 for importance of design features (Jeffries & Rizzolo). Scores are calculated by summing responses; higher scores represent increased recognition of design features in simulation.

Educational Practices Questionnaire (EPQ). A total of 16 items assess perceptions of educational best practices' presence and importance in simulation (Jeffries & Rizzolo, 2006). For each item, participants indicated their perceptions about a statement that described the presence of educational best practices. An "active learning" subscale contains 10 items measuring opportunities for active learning and participation in simulation. A "collaboration" subscale contains two items about working together with peers during simulation. A "learning diversity" subscale contains two items measuring opportunities for learning in simulation. Finally, a "high expectations" subscale contains two items measuring objectives and expectations presented during simulation (**Appendix C**). Response options and significance of score were identical to those described above for the SDS. Cronbach's alpha has been reported as 0.86 for the presence of educational best practices and 0.91 for importance of best practices embedded in simulation (Jeffries & Rizzolo). Scores are calculated by summing responses; higher scores represent increased recognition of educational best practices in simulation.

Data Analysis

We used commercially available statistical software (StataMP v.13 64-bit, College Station, Texas; MPlus v.7, Los Angeles, California) to perform psychometric testing on the SCLS, SDS, and EPQ.

Reliability. First, we quantified item response means, standard deviations, and corrected item-total correlations. The proportion of participants who provided the best possible response (strongly agree) indicated item difficulty/endorsement. Item difficulty of 0.3 indicates that few (30%) participants endorsed the item (e.g. the item may be too difficult), and 0.7 indicates that many (70%) participants endorsed the item (e.g. the item may be too easy); the best range for item difficulty scores is 0.3 to 0.7. Second, we examined item discrimination by comparing item difficulty scores between participants with total scores in the top and bottom thirds of the distribution. Our goal discrimination score was 30 percent or higher. Finally, we calculated Cronbach's alpha as an index of internal consistency. Generally, an acceptable alpha is > 0.75 (Cronbach, 1951).

Validity. First, we tested construct validity using CFA to determine if the individual items loaded on the subscales as expected (Schreiber, Stage, King, Nora, & Barlow, 2006). We performed CFA of reported scales using a randomly-selected 50 percent sample of observations ($n=1100$). Geomin (oblique) rotation, and weighted least square parametric estimation with mean- and variance-adjusted statistics were used. Several statistics were generated to assess overall model fit. Non-parametric χ^2 tests close to zero, comparative fit indices (CFI), Tucker-Lewis indices (TLI), and normed fit index (NFI) > 0.95 , root mean square errors of approximation (RMSEA) < 0.05 ,

weighted root mean square residuals (WRMR) <0.9 , and adjusted goodness of fit index (AGFI) >0.9 are common thresholds of acceptable fit (Browne & Kudek, 1993; Hu & Bentler, 1998; Kaplan, 2000; Schnermelleh-Engel, Moosbrugger, & Muller, 2003; Yu, 2002). Because the results of our CFA often suggested room for improvement in model fit, the second step in our study was EFA in the 50 percent sample ($n=1100$) that was not used for CFA. We allowed for up to six factors and then evaluated the models for optimum fit. The standardized root mean square residual (SRMR; goal <0.05 (Hu & Bentler, 1998)) replaced WRMR; otherwise, our choice of fit statistics was identical between CFA and EFA modeling. Finally, we used Pearson's correlations to quantify concordant validity (SCLS satisfaction and self-confidence scores) and discordant validity (SCLS and SDS and EPQ) at the summary score level. Desired results for concordant validity are greater than 0.7, while desired results for discordant validity are <0.5 .

Results

The vast majority of the sample ($N=2200$) was female. The average age of the sample was 22.8 years ($SD=4.5$). Fifty-four percent were in the junior year of a five-semester undergraduate nursing program. Seventy-five percent reported they had been active participants in simulation previously, and 84 percent rated their previous experience as positive.

Psychometric Analysis of the Satisfaction and Self-Confidence in Learning Scale

Reliability. The item analysis on the SCLS is presented in **Table 3.1**. Responses on the SCLS were skewed, with most participants responding either "Agree" or

“Strongly Agree” on all items. Item 13 (“It is the instructor’s responsibility to tell me what I need to learn from the simulation activity during class time” — the only reverse-coded item) had the greatest variance and was the most difficult for respondents to endorse (i.e. item difficulty was <0.3). Discrimination scores were all acceptable and ranged from 67 (item 13) to 94 percent (item 9). Cronbach’s alpha for the overall SCLS was 0.92. Alpha was 0.92 for the satisfaction and 0.83 for the self-confidence subscales, respectively. Removal of item 13 would have improved alpha to 0.94.

	SD	D	UN	A	SA	Mean ± SD	Inter-item Correlation
S1. The teaching methods used in this simulation were helpful.	0.41%	1.54%	3.93%	54.27%	39.86%	4.31 ± 0.67	0.44
S2. The simulation provided me with learning materials and activities to promote my learning.	0.23%	1.31%	4.97%	53.68%	39.81%	4.31 ± 0.65	0.45
S3. I enjoyed how my instructor taught the simulation.	0.18%	1.27%	5.42%	40.99%	52.15%	4.43 ± 0.68	0.45
S4. The teaching materials were motivating and helped me to learn.	0.27%	1.13%	6.78%	48.71%	43.11%	4.33 ± 0.68	0.44
S5. The way my instructor taught was suitable to the way I learn.	0.36%	1.40%	6.24%	43.88%	48.13%	4.38 ± 0.70	0.45
S6. I am mastering the content of the simulation.	0.36%	2.17%	8.32%	56.71%	32.45%	4.18 ± 0.70	0.45
S7. The simulation covered critical content necessary for mastery.	0.18%	1.18%	6.28%	51.65%	40.71%	4.31 ± 0.66	0.45
S8. I am developing the skills and obtaining the required knowledge to perform in a clinical setting.	0.27%	1.13%	6.33%	53.41%	38.86%	4.29 ± 0.66	0.45
S9. My instructors used helpful resources.	0.27%	0.68%	5.29%	48.13%	45.64%	4.38 ± 0.65	0.44
S10. It is my responsibility to learn what I need to know from this simulation activity.	0.14%	0.86%	5.15%	49.53%	44.33%	4.37 ± 0.64	0.46
S11. I know how to get help when I do not understand the concepts covered in simulation.	0.18%	0.54%	4.65%	50.66%	43.97%	4.37 ± 0.62	0.45
S12. I know how to use simulation activities to learn critical aspects of these skills.	0.18%	0.54%	5.51%	53.77%	39.99%	4.32 ± 0.62	0.45
S13. It is the instructor's responsibility to tell me what I need to learn during class time.	2.53%	9.99%	19.07%	42.30%	26.12%	3.79 ± 1.02	0.59

**Table 3.1. Response-option frequency for NLN Student Satisfaction and Self-Confidence with Learning scale (SCLS).
SD = Strongly Disagree, D = Disagree, UN = Undecided, A = Agree, SA = Strongly Agree.**

Validity. The CFA of the conceptual SCLS structure suggested there was room for improvement in model fit (**Table 3.2**). The RMSEA, WRMR, and χ^2 significance test indicated poor fit, while the CFI and TLI, NFI, and AGFI were above common thresholds of acceptability. The conceptual model accounted for 76 percent of the variance in the overall SCLS. The correlation between the satisfaction and self-confidence factors was 0.78.

	Student Satisfaction and Self-Confidence Scale			Simulation Design Scale			Educational Practices Questionnaire
	First CFA	EFA with Optimized Fit	Second CFA	First CFA	EFA with Optimized Fit	Second CFA	CFA
		Fit					
RMSEA	0.115	0.117	0.101	0.066	0.055	0.059	0.103
90% CI	0.109, 0.122	0.110, 0.124	0.094, 0.108	0.062, 0.070	0.050, 0.060	0.055, 0.063	0.098, 0.108
CFI	0.979	0.979	0.987	0.983	0.994	0.987	0.971
TLI	0.975	0.970	0.983	0.98	0.988	0.984	0.965
NFI	0.978	0.978	0.986	0.919	0.992	0.984	0.969
AGFI	0.973	0.968	0.982	0.909	0.984	0.980	0.962
WRMR	1.994	NA	1.657	1.289	NA	1.130	1.677
SRMR	NA	0.033	NA	NA	0.012	NA	NA
Chi square	1027.595	875.711	656.046	960.429	442.404	779.963	1287.120
p-value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Table 3.2. Fit statistics. Desired results for a Chi square significance test of model fit are close to zero and nonsignificant. Desired results for the CFI, TLI, and NFI are 0.95 or greater. Desired results for RMSEA and SRMR are less than or equal to 0.05, though values up to 0.1 might be considered acceptable. Desired results for WRMR are < 0.9. A rule of thumb for the AGFI is that 0.9 indicates a good fit and 0.85 indicates an acceptable fit. NA= not applicable.

Because the results of our CFA suggested there was room for improvement in model fit, we proceeded with EFA. A two-factor model had the best fit compared with CFA (**Table 3.2**). The RMSEA indicated there was additional room for improvement, but the CFI, TLI, SRMR, and χ^2 significance test represented good model fit. The EFA of the SCLS allowed for one item (9) to double load on the satisfaction and self-confidence subscales. One item (13) did not load well on to either subscale (**Figure 3.1**).

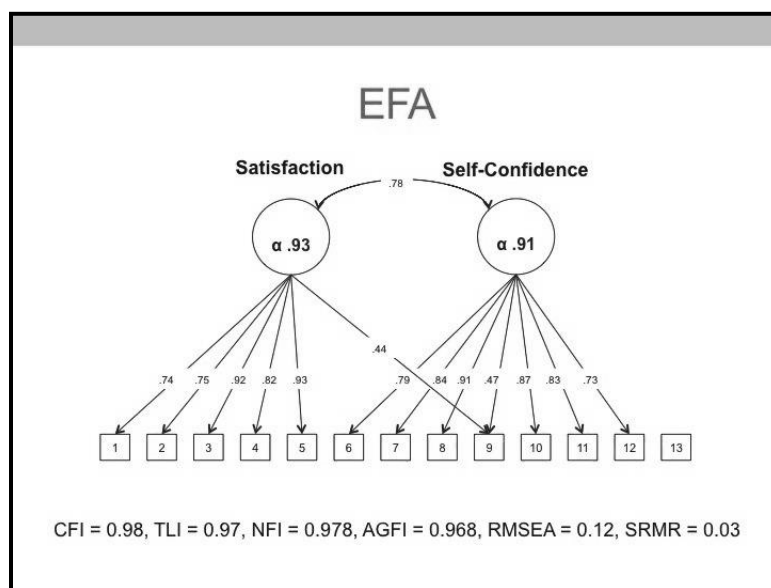


Figure 3.1. Factor loadings for SCLS. Desired results for CFI, TLI and NFI are 0.95 or greater; for RMSEA, less than or equal to 0.05; for SRMR, less than or equal to 0.05. Desired results for AGFI are greater than or equal to 0.9. CFI = comparative fit index; TLI = Tucker-Lewis index; NFI = normed fit index; AGFI = adjusted goodness of fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual.

Additional Assessments of Reliability and Validity. With item 13 removed, and allowing item 9 to double load on both factors, Cronbach's alpha improved for both subscales; alpha was 0.93 and 0.91 for the satisfaction for the self-confidence subscales, respectively. Alpha for the revised overall SCLS improved to 0.94. The satisfaction and self-

confidence subscales of the SCLS demonstrated strong concordant validity ($r=0.78$, $p=0.000$). The SCLS had poor discordant validity with the SDS ($r=0.66$, $p=0.000$) and EPQ ($r=0.72$, $p=0.000$). We also confirmed the results of the best fitting EFA factor solution using CFA and the confirmatory 50 percent of participants (**Table 3.2**).

Psychometric Analysis of the Simulation Design Scale

Reliability. Item response-option frequency distributions for the SDS were also skewed, with most participants responding either “Agree” or “Strongly Agree” (**Table 3.3**). All items had similar standard deviations and inter-item correlations. Discrimination scores were all acceptable and ranged from 79 (item 19) to 93 percent (item 5). Cronbach’s alpha for the overall SDS was 0.96 and would not have been improved with the removal of any item in particular. Alpha for the objectives & information, support, problem solving, feedback and guided reflection, and fidelity subscales were 0.92, 0.92, 0.86, 0.90 and 0.87, respectively.

Validity. Overall model fit of the conceptual SDS by CFA suggested there was room for improvement (**Table 3.2**). The RMSEA, NFI, WRMR, and χ^2 test of significance indicated poor fit, while the CFI, TLI, and AGFI were above common thresholds of acceptability. The conceptual model accounted for 85 percent of the variance in the SDS. The correlations among theoretical factors were between 0.67 and 0.89.

Because CFA results indicated there was room for improvement in model fit, we proceeded with EFA. A five-factor model had the most desirable fit (**Table 3.2**). The RMSEA, CFI, TLI, NFI, AGFI, SRMR, and χ^2 significance test indicated a better fit than with CFA. EFA allowed for two items (5 and 17) to double load on multiple subscales. One

subscale had only two items that loaded well (**Figure 3.2**).

	SD	D	UN	A	SA	Mean ± SD	Inter-item Correlation
D1. There was enough information for direction.	1.19%	2.96%	6.54%	42.93%	46.37%	4.31 ± 0.82	0.55
D2. I clearly understood the purpose and objectives.	0.91%	1.43%	4.59%	43.27%	49.81%	4.40 ± 0.73	0.54
D3. The simulation provided information in a clear manner.	0.72%	2.29%	7.26%	45.08%	44.65%	4.31 ± 0.76	0.54
D4. There was enough information provided to me.	0.67%	1.58%	6.45%	43.74%	47.56%	4.36 ± 0.74	0.54
D5. The cues were appropriate to promote understanding.	0.76%	1.53%	5.30%	41.74%	50.67%	4.41 ± 0.73	0.54
D6. Support was offered in a timely manner.	0.91%	0.91%	5.06%	40.31%	52.82%	4.43 ± 0.72	0.54
D7. My need for help was recognized.	0.72%	1.05%	6.73%	42.41%	49.09%	4.38 ± 0.73	0.55
D8. I felt supported during the simulation.	0.86%	1.15%	4.06%	36.58%	57.35%	4.49 ± 0.71	0.54
D9. I was supported in the learning process.	0.76%	0.76%	4.16%	36.01%	58.31%	4.50 ± 0.69	0.54
D10. Independent problem-solving was facilitated.	0.67%	1.72%	7.64%	48.42%	41.55%	4.28 ± 0.74	0.55
D11. I was encouraged to explore all possibilities.	0.67%	2.39%	10.08%	45.27%	41.60%	4.24 ± 0.79	0.55
D12. The simulation was designed for my specific level of knowledge and skills.	0.67%	1.15%	5.83%	44.84%	47.52%	4.38 ± 0.70	0.55
D13. The simulation allowed me the opportunity to prioritize nursing assessments and care.	0.62%	1.34%	6.07%	43.12%	48.85%	4.38 ± 0.71	0.55
D14. The simulation provided me an opportunity to goal set for my patient.	0.86%	3.34%	9.27%	45.32%	41.21%	4.22 ± 0.82	0.55
D15. Feedback provided was constructive.	0.76%	0.43%	3.92%	36.44%	58.45%	4.52 ± 0.67	0.54
D16. Feedback was provided in a timely manner.	0.81%	0.96%	3.58%	37.06%	57.59%	4.50 ± 0.69	0.54
D17. The simulation allowed me to analyze my own behavior and actions.	0.62%	1.15%	5.83%	39.92%	52.48%	4.42 ± 0.72	0.55
D18. There was an opportunity after the simulation to obtain guidance/feedback from the teacher.	0.76%	0.38%	3.39%	33.81%	61.65%	4.56 ± 0.65	0.55
D19. The scenario resembled a real-life situation.	1.62%	2.34%	9.74%	41.36%	44.94%	4.26 ± 0.85	0.55
D20. Real life factors, situations, and variables were built into the simulation scenario.	1.00%	1.39%	5.16%	40.78%	51.67%	4.42 ± 0.74	0.55

Table 3.3. Response-option frequency for NLN Simulation Design Scale (SDS).

SD = Strongly Disagree, D = Disagree, UN = Undecided, A = Agree, SA = Strongly Agree.

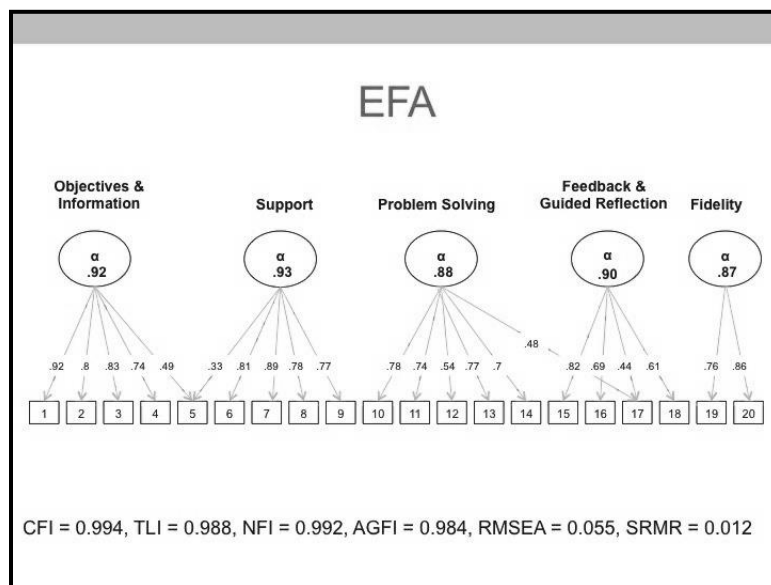


Figure 3.2. Factor loadings for SDS. Desired results for CFI, TLI and NFI are 0.95 or greater; for RMSEA, less than or equal to 0.05; for SRMR, less than or equal to 0.05. Desired results for AGFI are greater than or equal to 0.9. CFI = comparative fit index; TLI = Tucker-Lewis index; NFI = normed fit index; AGFI = adjusted goodness of fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual.

Additional Assessments of Reliability and Validity. After allowing two items to double load on multiple subscales, Cronbach's alpha for the subscales improved to: Objectives & information, 0.92; support, 0.93; problem solving, 0.88; feedback and guided reflection, 0.90; and fidelity, 0.87. Alpha for the overall SDS was unchanged at 0.96. We also confirmed the results of the best fitting EFA factor solution using CFA and the confirmatory 50 percent of participants (**Table 3.2**).

Psychometric Analysis on the Educational Practices Questionnaire

Reliability. Item response-option frequency distributions for the EPQ were also skewed, with most participants responding either "Agree" or "Strongly Agree" (**Table 3.4**). Item 4 of the EPQ had the greatest variance. Discrimination scores were all

acceptable and ranged from 75 (item 12) to 95 percent (item 8). Cronbach's alpha for the overall EPQ was 0.95 and would not have been improved with the removal of any item in particular. Alpha for the subscales was: Active learning, 0.93; collaboration, 0.90; diverse ways of learning, 0.88; and high expectations, 0.88.

Validity. Overall model fit of the conceptual SDS suggested there was room for improvement (**Table 3.2**). The RMSEA, WRMR, and χ^2 significance test indicated poor fit, while the CFI, TLI, NFI, and AGFI were above common thresholds of acceptability. The conceptual model accounted for 80 percent of the variance in the EPQ. Correlations among the conceptual factors were between 0.77 and 0.86.

EFA did not result in improved model fit and was therefore not informative in helping us understand how to organize the items on the EPQ.

	SD	D	UN	A	SA	Mean ± SD	Inter-item Correlation
E1. I had the opportunity to discuss the ideas and concepts with the teacher and other students.	0.79%	1.62%	3.98%	42.84%	50.76%	4.41 ± 0.72	0.53
E2. I actively participated in the debriefing session.	0.31%	0.49%	4.69%	42.86%	51.65%	4.45 ± 0.64	0.54
E3. I had the opportunity to put more thought into my comments during the debriefing session.	0.37%	0.88%	6.95%	46.55%	45.25%	4.35 ± 0.69	0.54
E4. There were enough opportunities to find out if I clearly understand the material.	0.46%	2.64%	5.6%	47.71%	43.54%	4.32 ± 1.12	0.56
E5. I learned from the comments made by the teacher before, during, or after the simulation.	0.32%	0.42%	3.52%	38.95%	56.79%	4.52 ± 0.62	0.53
E6. I received timely cues during the simulation.	0.60%	1.11%	4.86%	44.98%	48.45%	4.4 ± 0.7	0.53
E7. I had the chance to discuss the simulation objectives.	0.56%	1.39%	7.23%	44.74%	46.09%	4.34 ± 0.73	0.53
E8. I had the opportunity to discuss ideas and concepts with my instructor.	0.51%	0.97%	5%	44.09%	49.42%	4.41 ± 0.68	0.53
E9. The instructor was able to respond to the individual needs of learners.	0.6%	1.44%	5.98%	42.1%	49.88%	4.39 ± 0.72	0.53
E10. Using simulation activities made my learning time more productive.	1.25%	1.71%	5.74%	41.55%	49.75%	4.37 ± 0.79	0.53
E11. I had the chance to work with my peers.	0.56%	0.19%	1.95%	27.47%	69.85%	4.66 ± 0.59	0.54
E12. During the simulation, my peers and I had to work on the clinical situation together.	0.46%	0.32%	2.08%	28.39%	68.74%	4.64 ± 0.59	0.54
E13. The simulation offered a variety of ways in which to learn the material.	0.46%	1.53%	5.79%	42.71%	49.51%	4.39 ± 0.71	0.53
E14. This simulation offered a variety of ways of assessing my learning.	0.56%	1.85%	6.53%	42.89%	48.17%	4.35 ± 0.74	0.53
E15. The objectives were clear and easy to understand.	0.56%	1.58%	5.88%	41.87%	50.12%	4.39 ± 0.73	0.53
E16. My instructor communicated the goals and expectations to accomplish.	0.7%	1.16%	5.33%	38.95%	53.87%	4.44 ± 0.71	0.53

Table 3.4. Response-option frequency for NLN Educational Practices Questionnaire (EPQ).
SD = Strongly Disagree, D = Disagree, UN = Undecided, A = Agree, SA = Strongly Agree.

Discussion

Simulation has become a ubiquitous learning and assessment tool for novice nurses, and evaluation of simulation effectiveness is relevant to academic and practice settings. This is the first psychometric study of the SCLS, SDS, and EPQ. Findings from this study of 2200 surveys completed by pre-licensure novice nurses provide sufficient empirical evidence to indicate that all three measures are both reliable and valid. There is room for improvement, however, in construct validity of the SCLS and SDS, and there are implications for future use of these measures based on our findings.

Regarding the SCLS, we propose using a revised 12-item, two-factor model that resulted in the best overall fit, and two subscales that are directly related to the conceptual model and that have excellent internal consistency. This recommendation is due in part to item 13 being a good candidate for removal based on item difficulty, failure to inform any subscale on the SCLS, and enhanced internal consistency of the overall SCLS and subscales when the item is omitted. In future iterations of the SCLS, educators and researchers alike should consider revising the wording for item 13, because it seems that novice nurse participants may not have understood the reverse coding, particularly as it was applied to one item only. Importantly, the correlation between the satisfaction and self-confidence subscales of the SCLS is very high; thus, satisfaction and self-confidence in learning cannot be considered conceptually or statistically independent. This dependence between satisfaction and self-confidence in simulation learning also means that one subscale of the SCLS, not both, should be chosen as the target of simulation evaluation or used to quantify associations between satisfaction/self-confidence and other

outcomes of simulation.

With respect to the SDS, our EFA allowed for two items to double load on multiple factors. It is important that we not consider these factors independent conceptually or analytically, because allowing items to double load directly impacts correlations between the two factors. These two factors represent concepts that are closely related. The good news is that the best-fit, revised five-factor SDS model product of EFA is much improved compared to the results of CFA.

Interestingly, EFA is not a solution for all scales. CFA for the EPQ suggested there was room for improvement in model fit, so we proceeded with EFA. But, the utility of the EPQ fell apart after allowing for multiple loadings in EFA. Thus, EFA was not informative in helping us understand how to organize items on the EPQ.

Examining the discordant validity by comparing the SCLS with the SDS and EPQ is an important feature of this study, as researchers and nurse educators have used the three measures in combination. The SCLS had poor discordant validity with the SDS and EPQ, as high correlations at the level of summary score suggest the SCLS, SDS, and EPQ assess similar concepts. The lack of discordant validity was not necessarily a bad finding, but it requires us to recognize that the latent constructs are closely related. Researchers may use the SCLS, SDS, and EPQ to quantify change in an independent variable over time. Similarly, nurse educators may use the measures as assessments of simulation effectiveness. In either of these contexts, we recommend analysis of the correlation between summary scores for the SCLS, SDS, and EPQ. These three measures are not dissimilar.

It is also important to consider the reliability of these three measures. We looked at item difficulty scores as a source of reliability evidence for the SCLS, SDS, and EPQ. A majority of items on all three scales were skewed with most respondents selecting “Agree” or “Strongly Agree.” This ceiling effect means that these items were easy for novice nurses to endorse and therefore the items are not that difficult. If item difficulty is the exclusive focus of analysis, then researchers may exclude items with difficulty >0.7 . However, as item difficulty was not the exclusive focus of our analysis, we did not eliminate items based on difficulty statistics. Rather, we used information pertaining to item difficulty in combination with Cronbach’s alpha scores as measures of reliability. Not surprisingly, we found that excluding items based on item difficulty statistics actually would not improve Cronbach’s alpha significantly.

Overarching Recommendations

We have two recommendations for improving the SCLS, SDS, and EPQ. First, the use of items for both learner recognition of design feature/best practices and also importance of those features presents a measurement challenge in the SDS and EPQ. While the present study focused on reliability and validity testing for the learner recognition of design features/best practices, it seems that the importance items clutter analysis. It could be that the length of SDS and EPQ with both items on the recognition of simulation design features and importance of those features contribute to novice nurses’ fatigue and to the ceiling effect in terms of item difficulty scores. Second, it would be a good idea to consider adding another few items to the SDS and EPQ to increase trustworthiness. The SDS fidelity factor and EPQ collaboration, diverse ways of

learning, and high expectations factors each have two items, which is concerning in terms of trustworthiness of the factor actually capturing the latent construct. Having only two items on the subscale will have a detrimental impact on the internal consistency of the subscale because there are only two items across which to share error.

Strengths and Limitations

The first limitation of this study is that we selected a convenience sample from one liberal arts university. As such, the sample may underrepresent some groups based on age and race. Findings from this study could be different if samples of graduate nursing students or newly licensed novice nurses were involved in data collection. Thus, our results may not generalize to all novice nurse populations. Despite this limitation, our large sample size allowed us to randomly select separate confirmatory and exploratory subsamples for the conduct of confirmatory and when indicated exploratory factor analysis. The second limitation is that we only used data from our sample for concordant and discordant validity analysis because there are no other widely accepted measures of simulation outcomes for self-confidence, simulation design, or educational practices associated with simulation. Despite this limitation, our analysis of concordant and discordant validity makes meaningful contributions to the field of simulation evaluation.

Conclusion

This study makes a significant contribution to nursing education science because it provides a greater understanding of the value and limitations of the SCLS, SDS, and EPQ, which have been widely used to evaluate simulation outcomes under the assumptions that they have acceptable psychometric properties. This study adds robust

evidence based on statistical techniques to support the use of these measures and ensure that judgments made about simulation are valid and reliable (Florance, 2008). Moving forward, researchers have greater confidence about the validity and reliability of the SCLS, SDS, and EPQ.

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Chapter IV — COMPARISON OF EXPERT MODELING VERSUS VOICE OVER
POWERPOINT AND PRE-SIMULATION READINGS ON NOVICE NURSES'
COMPETENCE FOR PROVIDING CARE TO MULTIPLE PATIENTS

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This manuscript replaces aspects of traditional methods and results chapters. Ashley Franklin was the primary author on this paper and conducted the analysis under the direction of Dr. Lee during her tenure at OHSU. Dr. Sideras supervised data collection, while Drs. Tanner and Gubrud-Howe contributed to conception and design. Dr. Lee was the senior author on this paper. This paper will be submitted to *Journal of Nursing Education* (impact factor 1.133), an indexed and peer-reviewed journal with a larger readership of those interested in nursing education, as a full length research report after the dissertation defense.

The Institutional Review Board determined that this study was exempt.

Abstract

Background: Because of the complex needs of hospitalized patients today, nurses' competence and strategies to improve competence are of growing importance. Simulation is one way nursing education addresses the development of competence, but little evidence exists for comparing how pre-simulation assignments further influence competence. It is generally accepted that simulation is effective at increasing novice nurses' competence for providing care to one patient, but how simulation with multiple patients impacts novice nurses' competence remains unknown.

Methods: A pilot randomized control trial was used to compare the efficacy of three simulation preparation methods (expert modeling/intervention, voice over PowerPoint/active control, and reading assignments/passive control) on improving competence for providing care to multiple patients among senior undergraduate novice nurses. Competence was measured at two time points (baseline and following a five week intervention) by two blinded reviewers using the Creighton Simulation Evaluation Instrument™.

Results: Twenty novice nurses participated in the trial. There were no significant differences in the raw improvements in competence among the three groups; but, the expert modeling (Cohen's $d = 0.413$) and voice over PowerPoint methods (Cohen's $d = 0.226$) resulted in greater improvements in competence compared with the passive control.

Conclusions: This pilot trial provides a foundation of evidence for using expert modeling and voice over PowerPoint as simulation preparation to increase novice nurses' competence in new, complex simulation scenarios and future full-scale trials.

Background

Broadly, we know that simulation can bring together theory and practice for novice nurses and offer a forum to advance competence and clinical judgment (Dillard et al., 2009; Guhde, 2011; Jarzemsky & McGrath, 2008; Lasater, 2007; Liaw et al., 2010; Mould, White, & Gallagher, 2011). There is evidence from educational research to support that simulation is effective at increasing novice nurses' competence for providing care to one patient (Adamson, 2012; Cardoza & Hood, 2012; LeFlore, Anderson, Michael, Engle, & Anderson, 2007; Rockstraw, 2006), when competence is operationalized as skills including communication, collaboration, and clinical judgment.

In her seminal article, Dr. Benner addressed the importance of considering competence in context of situational demands, resources, and constraints that are inherent to actual nursing practice and not assessing competence in a controlled skills lab environment (Benner, 1982). Prior to the influx of high-fidelity simulation in nursing education programs, it was necessary to measure competence outside of a skills lab environment in order to incorporate the complexities of actual nursing practice into competence assessment. However, it is important to consider how nursing has evolved with increasing evidence that simulation can effectively depict the context of actual nursing practice in a controlled and psychologically safe environment (Jeffries, 2005, 2007; Lasater, 2007). Thus, in the tradition of modern nursing education with high-fidelity simulation fully integrated into curricula, it is possible that assessments of competence in simulation may translate to a realistic estimate of competence in actual nursing practice.

For the purposes of this study, we used Benner's definition of competence — "...the ability to perform to an expected standard with desirable outcomes..." (Benner, 1982, p.304). The overarching purpose of interventions tested in this research is to help novice nurses enhance competence, wherein eventually they would be able to identify signs and symptoms representing a change in patient status, notice and understand the "big picture" of relationships between physiologic states, anticipate changes in patient condition, and alter care protocols (Benner, Tanner, & Chesla, 2009).

Competent performance in a simulation assessment differs from the competent stage of development for nursing practice. In the competent stage, nurses are able to notice changes in a patient's situation and recognize the need for a subsequent re-direction in their goals and plan of care (Benner et al., 2009). Attaining such a competent stage of nursing practice usually occurs about two years after licensure, when nurses display increased clinical understanding, technical skills, organizational ability, and an ability to anticipate a likely course of events (Benner et al.). It is unrealistic for educators to expect that novice nurses — those in nursing school — would be able to discriminate these clinical judgments, because novice nurses' judgments are instead characterized by a focus on the present shift or task at hand and rule-based thinking (Benner et al.)

We have significant knowledge gaps in the understanding of how simulation influences novice nurses' competence. One gap relates to how simulation preparation increases novice nurses' competence. Thus, the purpose of this pilot trial was to compare the efficacy of three simulation preparation methods on novice nurses' competence in a multiple patient simulation.

Literature Review

There are three general methods nurse educators use to help novice nurses prepare for simulation. First, historically it is common practice for educators to assign novice nurses articles or supporting materials to read in preparation (McCausland, Curran, & Cataldi, 2004), which help to orient novice nurses to the upcoming simulation (Rosen et al., 2010). Second, recent education trends suggest pre-recorded voice over PowerPoint lectures are effective ways to prepare novice nurses for simulation (Bergmann & Sams, 2012; Ferreri, 2013; Prober & Heath, 2012; Watters, 2012; Wolf & Massaro, 2013). Third, our novel intervention involves pre-simulation expert modeling videos to enhance competence (Anderson, Aylor, & Leonard, 2008; Johnson et al., 2012; Rosen et al., 2010; Selle, Salamon, Boarman, & Sauer, 2008). Each of these three preparation methods for simulation may increase novice nurses' competence, but there is no evidence at this time to support that any of the three methods is superior to the other.

Both expert modeling videos and voice over PowerPoint are self-paced, mastery-based teaching strategies that will increase novice nurses' engagement in their simulation preparation because they make case-based teaching more active (Prober & Heath, 2012). Both teaching strategies allow for learner-centered, rich interactions during simulation (Bergmann & Sams, 2012). Additionally, faculty give credit to these Flipped Classroom teaching strategies for minimizing variance in understanding of course content and helping novice learners accept responsibility for their learning (Bergmann & Sams).

Expert modeling videos in nursing education provide exemplars of technical, behavioral, and cognitive skills demonstrated by an expert in a specific patient-case

context (LeFlore et al., 2007). Healthcare professionals and educators from medicine (Zhang & Chawla, 2012), nursing (Aronson, Glynn, & Squires, 2013; Guhde, 2010; Johnson et al., 2012; LeFlore et al., 2007; McConville & Lane, 2006), dentistry (Nikzad, Azari, Mahgoli, & Akhondi, 2012) and allied health (de Godoy, Costa Mendes, Hayashida, Noguiera, & Marchi Alves, 2004; Selle et al., 2008) report that expert modeling videos are useful as a teaching strategy because the video model becomes a standard of reference for future practice and thus deepens learning (Anderson et al., 2008). A recent multi-site study found that expert modeling videos favorably influenced novice nurses' competence for providing care to a geriatric perioperative patient in simulation (Johnson et al.). Similarly, expert modeling videos have improved novice nurses' competence for performing physical assessment in traditional hospital-based clinical experiences (Guhde). Accordingly, using a pre-simulation expert modeling video may be one way to increase novice nurses' competence in simulation and consequently in actual practice.

We adopted the expert modeling element of Social Cognitive Theory to serve as the theoretical framework for our research (Bandura, 1977). Bandura (1977) proposed that new skills can be learned through observation of experts modeling correct behaviors and subsequent reinforcement of these behaviors in practice. Modeling and observational learning are primary means of achieving behavioral changes and acquiring new technical skills (Bandura; Bandura & Carroll, 1987). Additionally, modeling forward reasoning may allow the learner to more completely grasp problem-solving and thinking skills used in expert performance (Anderson et al., 2008; Johnson et al., 2012). Thus, observing an

expert performance increases an individual's capabilities and promotes positive change in behavior (Christian & Krumwiede, 2013).

Using expert modeling videos may increase novice nurses' competence because videos utilize several best practices of teaching. For example, expert modeling videos allow novices opportunities for repetition in learning which may also help increase competence (Bandura, 1977). Some educators suggest using video affords novice healthcare providers more clarity of instruction than could be provided in voice over PowerPoint lecture (Anderson et al., 2008; McConville & Lane, 2006). While watching expert modeling videos, observational learning occurs as novice providers pay attention to the expert model and symbolically retain the observations (Rosen et al., 2010). Thus, the cognitive rehearsal of vicarious learning through observation of expert modeling provides a guide for future practice (Anderson et al.). In summary, novice nurses can have increased competence after learning with expert modeling videos, particularly because expert modeling videos utilize several best practices of teaching.

This pilot randomized control trial addressed the following research question: "In the context of multiple patient simulation, does expert modeling have greater efficacy in improving novice nurses' competence than voice over PowerPoint or reading assignments used as simulation preparation?"

Methods

Design and Power Analysis

This study was a three-arm, single blind, pilot randomized control trial that was designed to test the expert modeling intervention against voice over PowerPoint (active

control) and reading assignments (passive control). As there were no previous studies of expert modeling interventions with multiple patient simulations for novice nurses, the intent was to generate effect size estimates for a future full-scale trial.

Population and Sample

This study was conducted in the simulation lab at a nursing school in the Pacific Northwest region of the United States. We recruited a convenience sample of 20 senior, pre-licensure novice nurses enrolled in an integrative practicum clinical course. All 48 novice nurses in the course were invited to participate. There were no exclusion criteria. To control for the individual novice nurse abilities and knowledge variables, we randomly assigned novice nurses to one of three study groups. Institutional Review Board approval was received, and all participants provided informed consent.

Multiple Patient Scenario

The scenario involved care of three simulated patients at the beginning of shift in an acute care simulation setting, thus providing opportunities for novice nurses to practice both technical and non-technical skills. The scenario started with a 15-minute scripted bedside nursing shift report. Novice nurses completed the scenario independently while acting in the role of a Registered Nurse (RN). After obtaining shift report, novice nurses had 45 minutes to prioritize care of the three patients, delegate tasks to an unlicensed nursing assistant, perform technical skills including safety checks and focused physical assessments, administer morning medications, and communicate with a licensed independent provider (LIP) over the telephone using an SBAR communication tool (Bello, Quinn, & Horrell, 2009; Joint Commission, 2009). The three simulation patients

had diagnoses of respiratory distress, diabetic complications, and cardiovascular disease. Out of three simulation patients, one required rescue interventions, such as prn medication administration, communication with an LIP, or oxygen titration. There were inherent time constraints related to assessments and medication administration that required novice nurses to utilize time management and priority setting skills. Thus, a multiple patient scenario in the context of beginning of shift provided opportunities for novice nurses to demonstrate both technical and non-technical skills.

An important feature of this multiple patient scenario was hands-on practice with delegation to an unlicensed nursing assistant. We used a trained actor to portray the nursing assistant role; involving an actor added to the fidelity of the scenario and required novice nurses to consider the differences in scope of practice. The actor was a “float pool” nursing assistant who was not familiar with the daily routine of the acute care simulation setting and therefore needed specific instructions about what tasks the RN expected the nursing assistant to complete during the shift. This aspect in the multiple patient scenario presented an occasion for novice nurses to practice delegation, which is a skill known to be challenging for novice nurses (Berkow, Virkstis, Stewart, & Conway, 2008).

Logistics of facilitating a multiple patient scenario are essential to consider. First, the research team validated the scenario with samples of pre-licensure novice nurses over a period of four years. Second, this simulation required a cadre of facilitators and support staff. During data collection, one blinded study personnel operated all three of the simulators and served as the patient voices. Additionally, two blinded raters watched the

scenario from the control room and rated the novice nurses' performance using the Creighton Simulation Evaluation Instrument™ (CSEI). We also had a multimedia specialist to facilitate audio-video recording of the scenario. Finally, implementing this multiple patient scenario required a detailed script of simulation patient details, props, cues, and a plan to support novice nurse participants. We maintained fidelity to the protocol by scripting all dialogue and planning changes in patient condition at specific time points. Multiple team meetings and a dry run of the scenario ensured successful implementation of logistics.

We used a multiple patient scenario for both pre-test and posttest simulation assessments. Simulation patients had similar diagnoses and presentation in pre- and posttest scenarios, but patient identities changed. The research team mapped complexity of pre- and posttest simulation scenarios for congruence related to competence behaviors. From a research standpoint, it was important that the pre-test and posttest scenarios were similar in order to make causal inferences about change in novice nurses' competence over time.

Study Groups

We designed this pilot study to optimize amount of exposure and implement three different simulation preparation methods. Materials for all three groups were delivered via a Sakai online learning management system. We instructed all participants to view group-specific materials at least four times over five weeks between pre- and posttest simulation assessments; Sakai tracked the number of times participants accessed group-

specific materials. All groups had access to articles, policies, and pertinent procedures (Figure 4.1).

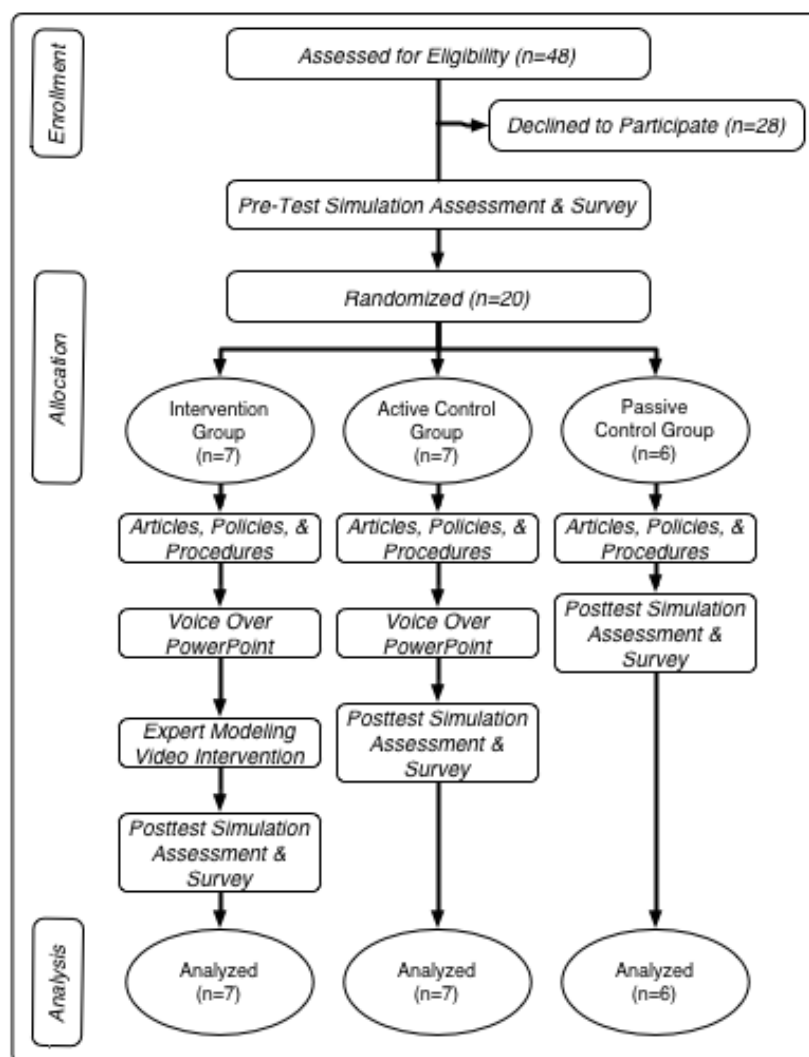


Figure 4.1. Randomized Control Trial Flow.

Expert modeling video/intervention group. Participants had access to 70 minutes of expert modeling videos and voice over PowerPoint, available over five weeks on Sakai. The principal investigator was the expert model in the videos and modeled care of one post-operative patient. Modeling included examples of technical and behavioral skills as well as think aloud techniques to elaborate on expert clinical reasoning and

habits of mind (e.g. priority setting and organizing nursing care). Expert modeling videos addressed content related to seven concepts: Taking report with a graphic organizer worksheet, prioritizing elements of patient care, delegating to unlicensed assistive personnel, performing safety checks and focused physical assessments, administering medication safely, and using an SBAR communication tool (Bello et al., 2009; Joint Commission, 2009).

Voice over PowerPoint/active control group. Participants had access to 45 minutes of voice over PowerPoint slides plus 8 online activities, available over five weeks on Sakai, specifically to match exposure and content with the expert modeling video group. The script for PowerPoint was identical to the expert modeling video script as described above. There were static photos, interactive games, and hyperlinks to online resources pertaining to the content. The principal investigator narrated the voice over PowerPoint.

Reading assignments/passive control group. Participants had access to articles, policies, and procedures on Sakai. The estimated time required for participants to review these materials was 45 minutes.

Data Collection

Evaluation involved blinded rater-observer measures of competence during pre- and posttest simulations assessments. There were two blinded raters, and we measured kappa coefficients of inter-rater reliability.

Instrumentation

Competence was measured using the CSEI (Todd, Manz, Hawkins, Parsons, & Hercinger, 2008). The CSEI is a 22 item rater-observation measure of competence with dichotomous response options (**Appendix D**). The CSEI has been used once previously in multiple patient simulation research (Frontiero & Glynn, 2012). Published interrater reliability on each of four subscales was between 84 and 87 percent (Parsons et al., 2012), and our research team improved interrater reliability by translating each item into a specific description of behavioral expectations. Scores are calculated by summing responses, and higher scores on the CSEI represent increased competence.

Randomization and Blinding

We used commercially available statistical software (StataMP 13, College Station TX) to randomize participants. First, we seeded a random number generator with a known sequence of number and generated a random number variable between 0 and 1. Next, we sorted the random numbers and split the sample into three equal-size groups. The principal investigator, simulation facilitator, raters, and quantitative methodologist were blinded to group assignment. An instructional designer who managed our learning management site was the only person aware of group assignment and therefore was not involved in data collection or analysis.

Analysis

Standard descriptive statistics of frequency, central tendency, and dispersion were used to describe the demographic characteristics of the sample using StataMP 13 (College Station, TX). We used Pearson χ^2 analysis to compare demographics among

groups. Analysis centered on comparison of novice nurses' competence among three groups. We used one-way mixed-effects ANOVA on the raw change scores from pre- to posttest simulation assessments, with the intention of generating Cohen's *d* and eta-squared. Where results were statistically insignificant, we combined the expert modeling and voice over PowerPoint groups for further analysis as a comparison to the reading group. Additionally, we explored areas of greatest response to expert modeling videos using Cohen's *d* with comparisons to voice over PowerPoint.

Results

A total of 20 novice nurses participated. Demographic characteristics of the participants and study groups are available in **Table 4.1**. The three groups were similar in age, previous degree, and number of hours worked per week. Irrespective of the arm to which novice nurses were randomized, they viewed intervention materials a similar number of times. The kappa statistic for interrater reliability on the CSEI was 0.811, and correlation of raw change scores between two blinded raters was 0.76 indicating that raters were similarly sensitive to change. Because the rater statistics were statistically indistinguishable, we used the experienced rater's scores in analysis, which were slightly more conservative.

Variables	Randomization group (%)			p value
	Reading n (%)	Voice Over PowerPoint n (%)	Expert Modeling n (%)	
n	6	7	7	
Gender, Female	3 (50)	7 (100)	6 (85.7)	0.01*
Age,				
22-26	4 (66.7)	2 (28.6)	4 (57.1)	0.25
27-32	-	2 (28.6)	2 (28.6)	
33-38	2 (33.3)	3 (42.9)	1 (14.3)	
Race,				
Caucasian	4 (66.7)	7 (100)	6 (85.7)	<0.01*
Ethnicity,				
Non-Hispanic or Latino	5 (83.3)	7 (100)	7 (100)	<0.01*
Previous Degree	2 (33.3)	3 (42.9)	4 (57.1)	0.66
Previous Work in Healthcare,	4 (66.7)	5 (71.4)	3 (42.9)	0.04*
CNA	1 (16.7)	1 (14.3)	2 (28.6)	
Learning Style Preference,				
Read/Write	1 (16.7)	-	1 (14.3)	<0.01*
Kinesthetic	5 (83.3)	7 (100)	6 (85.7)	
Mean Hours Worked/Week	14.8	14.3	12	0.90

Table 4.1. Demographics.

ANOVA results for raw change in competence scores across groups were not significant, $F(2, 17)=0.29$, $p=0.749$, eta-squared 0.033. Change in competence scores was greater in the expert modeling group ($d=0.413$) and the voice over PowerPoint group ($d=0.226$) compared with the reading group (**Table 4.2, Figure 4.2**). Because the group effects were not significant, we combined the expert modeling and voice over PowerPoint groups and repeated the ANOVA. These results were not significant, $F(1, 18)=0.46$, $p=0.507$, eta-squared 0.025. Finally, we compared raw changes in the expert

modeling versus voice over PowerPoint with a t test, and the results were not significant $t(12) = 0.39$, $p = 0.352$, Cohen's $d = 0.208$.

	Pre-test Mean \pm SD	Posttest Mean \pm SD	Raw Change Mean \pm SD
Reading	15.8 \pm 7.0	16.3 \pm 0.8	0.50 \pm 6.25
VOPP	16.1 \pm 2.8	18.0 \pm 4.4	1.86 \pm 5.81
Expert Modeling	17.7 \pm 6.9	20.9 \pm 4.9	3.14 \pm 6.52

Table 4.2. Competence Scores. VOPP = voice over PowerPoint.

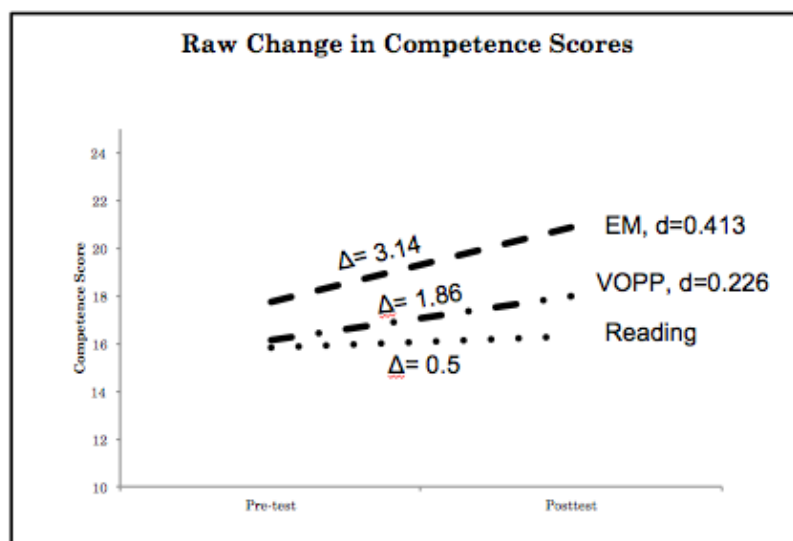


Figure 4.2. Δ = raw change in competence scores between pre-test and posttest, EM = expert modeling group, VOPP = voice over PowerPoint group.

To further examine fidelity of the expert modeling intervention and identify areas where the expert modeling intervention was most effective, we calculated raw change scores and effect sizes for each of the CSEI subscales while comparing the expert modeling to voice over PowerPoint groups. The strongest effect sizes favor delegation (Cohen's $d = 0.419$) and safety checks (Cohen's $d = 0.241$).

Discussion

Simulation is widely used in nursing education to increase novice nurses' competence. This is the first trial to investigate the efficacy of simulation preparation methods to further increase novice nurses' competence for providing care to multiple simulated patients. Findings from this pilot trial of 20 senior pre-licensure novice nurses indicate that expert modeling videos may be more effective than voice over PowerPoint or reading assignments before simulation to increase competence. Effect size estimates generated in this study will assist researchers to power future full-scale trials.

Previous expert modeling studies provide insight into efficacy of this simulation preparation method (Aronson et al., 2013; Johnson et al., 2012; LeFlore et al., 2007). First, expert modeling videos may increase competence in simulation because they present basic strategies for thinking like a nurse alongside behavioral demonstrations (Johnson et al.). Second, certain characteristics of an expert model that potentially increase competence; particularly, if the observer can relate to similar attributes in the model (Bandura, 1977; O'Connor et al., 2009), then novice nurses may be more motivated to continue expert behaviors in future practice (Anderson et al., 2008; Rosen et al., 2010). Finally, expert modeling videos with clearly defined outcomes likely further increase novice nurses' competence (Bandura, 1977).

Learning vicariously may be helpful for novice nurses before they have hands-on practical experience (O'Connor et al., 2009). In our study, novice nurses had a lack of recent clinical experience in acute care settings related to curriculum sequencing. Given the time lapse between acute care experiences, critics might assume that the novice

nurses were mimicking the expert model. Our intervention protected against mimicry as the expert model demonstrated care for one simulated patient while novice nurse participants provided care for three simulated patients with different medical conditions. To further discount the assumption of mimicry, nurse educators have pointed out that behavior performance after vicarious learning represents a learned behavior wherein participants use modeled behaviors and apply knowledge to forthcoming situations as needed (Rutherford-Hemming, 2012). Therefore, expert modeling can be effective both to teach new skills and modify knowledge that learners previously acquired (Gould & Roberts, 1982). We want to recognize that observation alone does not guarantee learning or transfer (Rosen et al., 2010); although observation starts the learning process, expertise is further developed through practice with self-regulatory and external feedback.

The findings of this pilot trial support previous studies where researchers used expert modeling with novice nurse participants. Two previous studies have used rater-observer measures after expert modeling in simulation. First, a multisite study using expert modeling as simulation preparation with care of a postoperative simulated patient reported large effect sizes for the influence of expert modeling videos on novice nurses' noticing, interpreting, and responding skills in a clinical scenario (Johnson et al., 2012). Second, a pilot study with nurse practitioner students used expert modeling in simulation and reported significant improvement in behavioral skills related to a pediatric asthma scenario (LeFlore et al., 2007). Additionally, researchers have used expert modeling videos and reported improvement in novice nurses' knowledge and appreciation for fundamental skills (Chau et al., 2001; Guhde, 2010).

There are many layers to this pilot trial. First, all groups were exposed to multiple patient simulation, and measuring competence was feasible in the setting of multiple patient simulation. Therefore, this work provides a foundation for using multiple patient simulation in future trials where competence in simulation is measured among several comparison groups. Second, this pilot trial tested both expert modeling and voice over PowerPoint interventions. Not only were our intervention efficacious, but they were also feasible. We want to highlight that novice nurse participants reported that viewing intervention materials was not difficult and that our Sakai learning management system was an appropriate technology platform.

An unexpected finding from our pilot study relates to the dose of expert modeling video required to impact novice nurses' competence. Though we instructed all participants to view group-specific materials four times over five weeks and provided weekly email reminders, data from the Sakai learning management system revealed participants in all three groups viewed materials one or two times. Our sample of senior pre-licensure novice nurses did not participate to the extent we expected even though we provided a 20 dollar gift card and 12 clinical hours as compensation for their time. We speculate that time requirements and the steep learning curve associated with their capstone clinical course could have decreased their engagement with intervention materials. Overall, we were satisfied that randomized group assignment did not impact one group more than the others and that one or two exposures to expert modeling videos improved competence scores. Our recommendation for future research is to consider additional participant incentives that might increase pre-licensure novice nurses'

participation and allow investigation of the dose of an expert modeling intervention required to achieve the desired effect.

Our post analysis of effect sizes to explore areas of greatest response to expert modeling videos makes a meaningful contribution to this line of research. The effect sizes comparing expert modeling videos to voice over PowerPoint indicate that our expert modeling intervention seems to be more influential on novice nurses' competence for delegation and safety checks. As there was room for improvement in the effect sizes for priority setting and focused physical assessment, we recommend providing additional patient examples for both concepts in future iterations of both expert modeling and voice over PowerPoint interventions. To further increase effect sizes, researchers could also consider adding additional practice time with multiple patients in simulation during open lab so novice nurses could work with peers from their randomized group to apply new knowledge in the context of patient scenarios. Adding additional practice time for novice nurses to work with one another is well aligned with the Deliberate Practice framework which focuses on intentional practice, immediate feedback and reflection (Ericsson, Whyte, & Ward, 2007) and consistent with recommendations from education experts about using simulation to increase novice nurses' competence (Kardong-Edgren, 2013).

Strengths and Limitations

One of the main strengths of our study is the randomized control trial design, which minimized threats to internal validity and allowed us to examine causal inference. The first limitation of this pilot trial is that we selected a convenience sample from one university. As such, the sample may underrepresent some groups based on age, gender, or

race. One demographic characteristic that was different between groups related to previous work in healthcare, as the expert modeling and voice over PowerPoint groups generally had more work experience that could contribute to their competence. Findings from this pilot study could be different if students from other campuses were included in data collection. Thus, our results may not generalize to all novice nurse populations. Despite this limitation, our analysis generated satisfactory effect size estimates for expert modeling videos and voice over PowerPoint used as simulation preparation, which are novel contributions to the literature and will help to power future full-scale trials. The second limitation is that we had a small sample size and limited power to detect statistically significant differences between groups. Despite this limitation, we conducted a rigorous pilot study of our expert modeling intervention and two comparison interventions.

Implications for Nursing Education

This pilot randomized control trial makes a significant contribution to nursing education because it provides effect size estimates for the efficacy of expert modeling videos and voice over PowerPoint as simulation preparation. Both types of simulation preparation seem to have a positive impact on increasing novice nurses' competence above and beyond the effect of reading assignments commonly used as simulation preparation. Expert modeling videos may be most beneficial when used to help novice nurses re-enter simulation with acute care patients after having clinical experiences in community settings. Additionally, expert modeling videos may help novice nurses early in their curriculum who need to see an example of thinking and acting like a nurse.

Future research is needed to investigate how expert modeling videos enhance competence in simulation and in actual nursing practice.

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Chapter V — EFFECTIVENESS OF AN EXPERT MODELING INTERVENTION ON
NOVICE NURSES' SELF-EFFICACY IN MULTIPLE PATIENT SIMULATION

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This manuscript replaces aspects of traditional methods and results chapters. Ashley Franklin was the primary author on this paper and conducted the analysis under the direction of Dr. Lee during her tenure at OHSU. Drs. Tanner, Gubrud-Howe and Sideras contributed to conception and design. Dr. Lee was the senior author on this paper. This paper will be submitted to *Journal of Nursing Scholarship* (impact factor 1.612), an indexed and peer-reviewed journal with a larger readership of those interested in nursing research, as a full length research report after the dissertation defense.

The Institutional Review Board determined that this study was exempt.

Abstract

Background: Self-efficacy is essential to nurses' abilities and performance in the clinical setting, because it can help them overcome difficult situations. One way that nurse educators aim to improve novice nurses' self-efficacy is through simulation. Anecdotally, we know that pre-simulation assignments increase novice nurses' self-efficacy, but little empirical evidence exists for comparing the effectiveness of different simulation preparation methods.

Methods: A pilot randomized control trial was used to compare three simulation preparation methods (expert modeling/intervention, voice over PowerPoint/active control, and reading assignments/passive control) on improving self-efficacy for providing care to multiple simulated patients. Self-efficacy was measured at baseline and following a five week intervention with a modified National League for Nursing Student Satisfaction and Self-Confidence in Learning scale.

Results: Twenty senior undergraduate novice nurses participated in the trial. There were no significant differences in the relative improvement in self-efficacy among the three groups; but, the voice over PowerPoint (Cohen's $d = 1.363$) and expert modeling methods (Cohen's $d = 1.068$) resulted in greater improvements in self-efficacy compared with the passive control. When combined, the expert modeling and voice over PowerPoint groups had significantly greater improvements in self-efficacy compared with the passive control, $t = 3.08$, $p = 0.003$, Cohen's $d = 1.501$.

Conclusions: Expert modeling videos and voice over PowerPoint can increase novice nurses' self-efficacy for providing care to multiple patients. Presently, care of multiple

patients is informally and infrequently addressed in undergraduate nursing curricula, yet novice nurses are expected to provide care for multiple patients upon licensure. Both expert modeling videos and voice over PowerPoint are beneficial to increase novice nurses' self-efficacy in complex simulation scenarios beyond the usual practice of reading as simulation preparation.

Background

Self-efficacy refers to a person's sense of effectiveness (Smith, 1989), wherein one perceives they are capable of performing in a certain manner to achieve specific goals (Bandura, 1986). Self-efficacy is essential to nurses' abilities and performance in the clinical setting (Dykes, 2011), because a nurse's self-efficacy can help them overcome patient care situations that are distressing and evoke anxiety. As novice nurses progress through undergraduate coursework and the first six months of independent practice (Benner, 2009), their self-efficacy for delivering nursing care and relative perception of success are critical to advancement (Tanner, 2006). One way that nurse educators support self-efficacy is by facilitating well-planned simulations that offer a psychologically safe place to practice making clinical judgments (Jeffries, 2005; Lasater, 2007). Thus, simulation can significantly increase novice nurses' sense of effectiveness early in their nursing career.

Self-efficacy is malleable and sensitive to change through simulation (Arnold et al., 2009). Numerous studies have evaluated novice nurses' self-efficacy after simulation (Bantz, Dancer, Hodson-Carlton, & Van Hove, 2007; Bremner, Aduddell, Bennett, & VanGeest, 2006; Cardoza & Hood, 2012; Eaves & Flagg, 2001; Henneman & Cunningham, 2005; Kuznar, 2007; Lasater, 2007; McCausland, Curran, & Cataldi, 2004; Rockstraw, 2006). The most comprehensive evidence to support self-efficacy outcomes following simulation comes from a meta-analysis of 11 two-group pre- and posttest studies, where simulation had a significant increase in novice nurses' self-efficacy compared to alternate teaching strategies (Franklin, & Lee, in press). From this work, it is

clear that simulation is effective to increase novice nurses' self-efficacy for providing care to a simulated patient.

Building on the evidence that simulation positively influences novice nurses' self-efficacy, it is appropriate to evaluate how simulation preparation further increases self-efficacy. There is a paucity of evidence testing simulation preparation methods. Historically, it is common practice for educators to give reading assignments in preparation for simulation (McCausland et al., 2004). However, recent education trends suggest pre-recorded voice over PowerPoint lectures may be effective ways to prepare novice nurses for simulation (Bergmann & Sams, 2012; Ferreri, 2013; Watters, 2012; Wolf & Massaro, 2013). Voice over PowerPoint and other Flipped Classroom teaching strategies, including expert modeling videos, make case-based learning more active (Prober & Heath, 2012) and have been popular with learners in higher education settings (Ferreri, 2013). Additionally, our novel pre-simulation expert modeling video intervention may increase self-efficacy because it minimizes variance of content (Bergmann & Sams) and the expert model becomes a standard of reference for simulation (Anderson, Aylor, & Leonard, 2008). All of these simulation preparation methods may increase novice nurses' self-efficacy, but there is no evidence at this time to support that any of the three methods is superior to the other.

Literature Review and Theoretical Framework

Improving novice nurses' self-efficacy in the context of a multiple patient simulation is particularly important because novice nurses have reported that low self-efficacy for providing care to multiple patients negatively affects their competence

(Ebright, Urden, Patterson, & Chalko, 2004). Yet, providing care for multiple patients is a reality for many novice nurses who accept graduate nurse positions on medical-surgical units in acute care hospitals where nurse to patient ratios are frequently 1:5 in the United States (Aiken et al., 2011). Simulation can mimic the reality of acute care hospitals by using mannequin patients, electronic documentation, bar code medication administration, and offering opportunities for collaboration among interprofessional teams. Further, multiple patient simulation can increase novice nurses' non-technical skills for priority setting and delegation to unlicensed assistive personnel (Kaplan & Ura, 2010; Radhakrishnan, Roche, & Cunningham, 2007). Therefore, participating in a multiple patient simulation may increase novice nurses' self-efficacy and their competence, because experiences in simulation mimic the situational demands, constraints, and resources of an acute care hospital environment.

A significant benefit of multiple patient simulation is the opportunity for novice nurses to practice skills that are not available to them in traditional hospital-based clinical experiences. Some examples of management skills applied in multiple patient simulation are the occasions for novice nurses to listen to report, organize their plan for multiple patients, prioritize focused physical assessments based on salient items from report, and administer medications to multiple patients (Kaplan & Ura, 2010; Radhakrishnan et al., 2007). Further, opportunities for delegation to unlicensed assistive personnel add complexity to the simulation. Multiple patient simulation also offers novice nurses the chance to practice technical nursing skills including hand hygiene and using two patient identifiers (Frontiero & Glynn, 2012). Because multiple patient assignments are not

frequently available to novice nurses in traditional hospital-based clinical experiences, it is important to consider the need for repeated multiple patient simulations (Ironside, Jeffries, & Martin, 2009) and targeted simulation preparation (Radhakrishnan et al.) to further influence novice nurses' self-efficacy.

Four research teams have published multiple patient simulation studies (Frontiero & Glynn, 2012; Ironside et al., 2009; Kaplan & Ura, 2010; Radhakrishnan et al.). All four studies broadly focused on maintaining patient safety while providing care for two or more patients. Though the design of these studies is limited by self-report results (Kaplan & Ura), use of investigator-developed measures without psychometric validation (Ironside et al.; Radhakrishnan et al.), and small sample size (Frontiero & Glynn; Radhakrishnan et al.), the collective results indicate that multiple patient simulation is helpful to novice nurses. Three studies used competence (Frontiero & Glynn; Ironside et al.; Radhakrishnan et al.), and one used self-efficacy as a dependent variable (Kaplan & Ura). The self-efficacy outcomes reflected novice nurses' beliefs in their abilities to prioritize care, delegate, and work effectively in a team. These studies provide a foundation for additional research about how multiple patient simulation positively influences novice nurses' self-efficacy and their preparation to provide safe care in actual nursing practice.

We selected Social Cognitive Theory as the theoretical framework for our research (Bandura, 1986), because it contends that self-efficacy is the foundation of human agency. Bandura theorized that humans can overcome stressful situations through the positive influence of self-efficacy (Bandura, 2001). Furthermore, self-efficacy

dictates many facets of life — thinking, motivation, and decision-making (Rutherford-Hemming, 2012) — therefore, self-efficacy is integral to nursing practice. The terms self-efficacy and confidence are often used interchangeably, however Bandura (1977) argued that self-efficacy is specific to a particular goal whereas confidence is a personal characteristic referring to belief in one's self. Much of the nursing education literature uses the term confidence, but we have chosen to use self-efficacy to better align with Bandura's conceptual framework.

Bandura highlighted expert modeling as a significant source of self-efficacy (Bandura, 1977). Two studies have used expert modeling videos and evaluated self-efficacy outcomes with novice nurses. Both research teams tested the impact of expert modeling videos on novice nurses' self-efficacy and concluded that expert modeling videos were more effective to increase self-efficacy than traditional reading assignments and attending course lectures (Johnson et al., 2012; McConville & Lane, 2006). These findings suggest that expert modeling can be effective at increasing novice nurses' self-efficacy in simulation.

This study makes an innovative contribution by investigating the effectiveness of simulation preparation methods to increase novice nurses' self-efficacy for providing care to multiple simulated patients. Our pilot randomized control trial addressed the following research question: "In multiple patient simulation, does expert modeling have a greater influence on novice nurses' self-efficacy than voice over PowerPoint or traditional reading assignments used as simulation preparation?"

Methods

A detailed description of the design, sample, and procedures was published previously (Franklin, Sideras, Tanner, Gubrud-Howe, & Lee, 2014b). Briefly, novice nurses provided care for three mannequin patients for 45 minutes at the beginning of shift in an acute care simulation setting. We used a multiple patient scenario for pre-test and posttest. After the pre-test, all participants completed a self-efficacy survey and were randomized to one of three groups (expert modeling video, voice over PowerPoint, or reading assignments). Materials for all three groups were delivered via the Sakai online learning management system. Intervention content related to seven concepts: Taking report with a graphic organizer worksheet, prioritizing elements of patient care, delegating to unlicensed assistive personnel, performing safety checks and focused physical assessments, administering medication safely, and using an SBAR communication tool (Bello, Quinn, & Horrell, 2009; Joint Commission, 2009). Materials were available on Sakai for five weeks between pre- and posttest.

Data Collection

All participants completed a modified National League for Nursing Student Satisfaction and Self-Confidence in Learning scale (SCLS; Jeffries & Rizzolo, 2006) at baseline and after the five-week intervention. We measured self-efficacy with the self-confidence subscale of the SCLS. In previous work, we performed psychometric testing on the SCLS with a sample of 2200 surveys completed by novice nurses and made recommendations for using a modified SCLS that has acceptable reliability and validity

(Franklin, Burns, & Lee, 2014a). Scores are calculated by summing responses, and higher scores represent increased self-efficacy.

The SCLS is a general tool that measures the efficacy that novice nurses feel towards mastering simulation content and developing skills and knowledge to perform nursing tasks in a clinical setting. Additionally, the SCLS addresses how confident novice nurses feel that the content of simulation is necessary for nursing practice. The SCLS has been the most widely used self-efficacy measure in simulation research, though it is important to recognize that its foundation relates to educational best practices that facilitate self-efficacy (Chickering & Gamson, 1987) and not Social Cognitive Theory (Bandura, 1977). As such, some items on the SCLS relate to self-efficacy in learning and other items relate to self-efficacy for providing nursing care.

Analysis

Standard descriptive statistics of frequency, central tendency, and dispersion were used to describe the demographic characteristics of the sample with StataMP 13 (College Station, TX). We used Pearson's χ^2 analysis to compare demographics among groups. Our first analysis focused on comparison of novice nurses' self-efficacy among three groups. We used one-way ANOVA on the self-efficacy change scores from pre- to posttest, with the intent of generating effect size estimates in the form of Cohen's d and eta-squared. Where effects were statistically insignificant, we then combined the expert modeling and voice over PowerPoint groups for further analysis as a comparison to the reading group; we used a t test without assuming equal variance.

Results

A total of 20 novice nurses participated. Demographic characteristics of the participants and study groups are available in **Table 5.1**. The three groups were similar in age, previous degree, and number of hours worked per week, which was important because these characteristics could affect self-efficacy in a learning environment. Irrespective of the arm to which novice nurses were randomized, they viewed intervention materials a similar number of times. In order to account for groups with different levels of self-efficacy at baseline, we used relative change scores as the unit of analysis (**Table 5.2**).

Variables	Randomization group (%)			p value
	Reading n (%)	Voice Over PowerPoint n (%)	Expert Modeling n (%)	
n	6	7	7	
Gender, Female	3 (50)	7 (100)	6 (85.7)	0.01*
Age,				
22-26	4 (66.7)	2 (28.6)	4 (57.1)	0.25
27-32	-	2 (28.6)	2 (28.6)	
33-38	2 (33.3)	3 (42.9)	1 (14.3)	
Race,				
Caucasian	4 (66.7)	7 (100)	6 (85.7)	<0.01*
Ethnicity,				
Non-Hispanic or Latino	5 (83.3)	7 (100)	7 (100)	<0.01*
Previous Degree	2 (33.3)	3 (42.9)	4 (57.1)	0.66
Previous Work in Healthcare,				
CNA	4 (66.7) 1 (16.7)	5 (71.4) 1 (14.3)	3 (42.9) 2 (28.6)	0.04*
Learning Style Preference,				
Read/Write	1 (16.7)	-	1 (14.3)	<0.01*
Kinesthetic	5 (83.3)	7 (100)	6 (85.7)	
Mean Hours Worked/Week	14.8	14.3	12	0.90

Table 5.1. Demographics.

	Pre-test Mean \pm SD	Posttest Mean \pm SD	Relative Change Mean \pm SD
Reading	28.8 \pm 4.6	28.0 \pm 3.6	-0.02 \pm 0.08
VOPP	26.9 \pm 2.9	30.9 \pm 3.0	0.16 \pm 0.17
Expert Modeling	26.0 \pm 5.3	29.7 \pm 3.1	0.18 \pm 0.25

Table 5.2. Self-Efficacy Scores. VOPP= voice over PowerPoint.

ANOVA results for relative change scores across groups were not significant $F(2, 17)=2.37$, $p=0.124$, eta squared 0.218. Relative change in self-efficacy scores was greatest in the expert modeling group (Cohen's $d=1.068$) and voice over PowerPoint group ($d=1.363$) compared with the reading group (**Figure 5.1**). Because the group effects were not significant, we combined the expert modeling and voice over PowerPoint groups for further analysis as a comparison to the reading group. These results were significant, $t(18)=3.08$, $p=0.003$, Cohen's $d=1.501$.

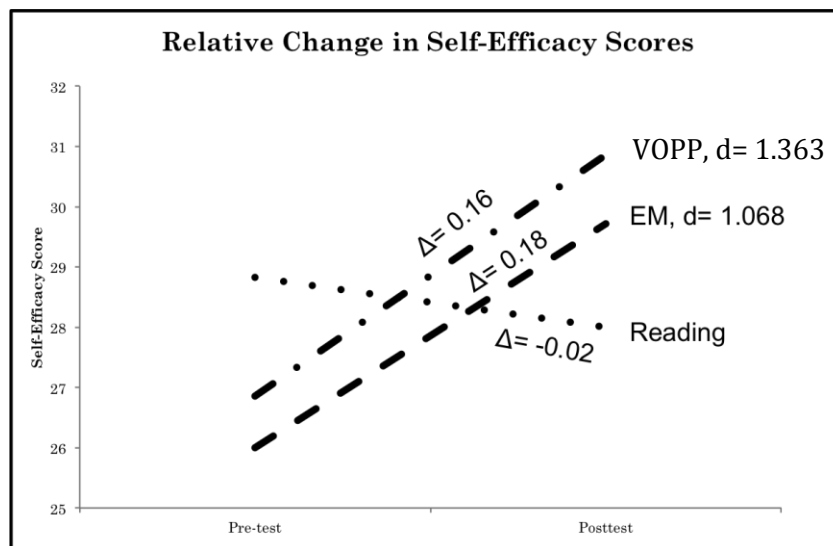


Figure 5.1. Δ = relative change in self-efficacy scores between pre-test and posttest, EM= expert modeling group, VOPP= voice over PowerPoint group.

Discussion

Nurse educators are interested in novice nurses' self-efficacy, because self-efficacy impacts behavior and outcomes (Zulkosky, 2012). Novice nurses describe low self-efficacy as a barrier to providing care to multiple patients (Ebright et al., 2004); consequently, this study makes a novel contribution by investigating the effectiveness of three simulation preparation methods to increase novice nurses' self-efficacy for

providing care to multiple simulated patients. Findings from this pilot study of 20 senior pre-licensure novice nurses indicate that expert modeling videos and voice over PowerPoint are more effective than reading assignments as simulation preparation to increase self-efficacy.

Our self-efficacy findings are similar to previous educational research comparing the effectiveness of expert modeling videos with reading assignments and attending course lectures. Johnson and colleagues (2012) measured the impact of expert modeling videos on novice nurses' care of a simulated postoperative patient experiencing delirium, and they found that the videos positively influenced novice nurses' clinical judgment and self-efficacy. Similarly, researchers in the United Kingdom found that expert modeling videos of nurses communicating with difficult patients increased novice nurses' self-efficacy (McConville & Lane, 2006). Both of these studies support the use of expert modeling videos to increase novice nurses' self-efficacy in simulation.

Expert modeling and voice over PowerPoint apply concepts from Flipped Classroom pedagogy, which encourages advanced preparation and active engagement (Bergmann & Sams, 2012; Prober & Heath, 2012). Nurse educators have used Flipped Classroom techniques in didactic lecture with advanced practice novice nurses and reported increased self-efficacy along with application of knowledge and motivation after in-class simulations (Wolf & Massaro, 2013). Flipped Classroom pedagogy is well aligned with antecedents to self-efficacy that Bandura (1977) identified. Specifically, voice over PowerPoint is an example of verbal persuasion providing instructions, suggestions, and advice to novice nurses, and expert modeling exemplifies vicarious

learning where novice nurses observe others' performance (Ziegler, 2005). Both expert modeling and voice over PowerPoint promote more engagement in simulation activities, which may contribute to performance accomplishments in simulation and also lead to increased self-efficacy. In our study, novice nurse participants reported increased self-efficacy from both expert modeling videos and voice over PowerPoint used as simulation preparation. These examples from advanced practice and pre-licensure novice nurses provide a foundation of evidence for using Flipped Classroom pedagogy as simulation preparation to increase novice nurses' self-efficacy.

Bandura's theoretical framework (1977) addressed the importance of self-efficacy to perseverance, where individuals with high self-efficacy have increased motivation to put forth extra effort and persist in order to achieve their goals (Bandura, 1986). Nurse educators have extended Bandura's framework to novice nurses by evaluating self-efficacy after interventions that prepare novice nurses for independent practice. Importantly, researchers have found that novice nurses with high self-efficacy possess a firmer commitment to use their clinical skills and have a better chance of meeting their clinical goals (Clark, Owen, & Tholcken, 2004). Therefore, possessing self-efficacy for providing care to multiple patients in simulation should assist novice nurses' transition to independent practice where caring for multiple patients is a reality in most acute care settings. There is evidence that multiple patient simulation studies increase novice nurses' self-efficacy and motivation for clinical practice (Kaplan & Ura, 2010), and this pilot study provides evidence that expert modeling videos and voice over PowerPoint further increase novice nurses' self-efficacy for providing care in a complex simulation.

Nurse scientists have applied Bandura's theoretical framework with diverse populations to evaluate interventions targeting behavior change (Ziegler, 2005). Moreover, there is evidence that self-efficacy is the most important predictor of behavior change (Lenz & Shortridge-Baggett, 2002). Recently, there has been critique of using self-efficacy as an outcome of educational research for novice healthcare providers related to poor correlation between self-efficacy and externally derived measures of competence (Eva, Regehr, & Gruppen, 2012; Kardong-Edgren, 2013). However, it is important to remember that self-efficacy is a temporary and easy-to-influence belief that is situation specific (Lenz & Shortridge-Baggett). Therefore, possessing high self-efficacy can be a way to help individuals develop new behaviors (Ziegler), though the behaviors are actually learned through observation and taught through modeling (Bandura, 1997). While self-efficacy does not guarantee learning or behavior change, high self-efficacy can lead to behavior change when accompanied by feedback, opportunities for behavioral practice, and when learners believe that behavior change is important.

Strengths and Limitations

One of the main strengths of our study is the randomized control trial design, which minimized threats to internal validity and allowed us to examine causal inference. The first limitation of this pilot trial is that we selected a convenience sample from one university. As such, the sample may underrepresent some groups based on age, gender, or race. One demographic characteristic that was different between groups related to previous work in healthcare, as the expert modeling and voice over PowerPoint groups

generally had more work experience that could contribute to their self-efficacy. Findings from this pilot study could be different if students from other campuses were included in data collection. Thus, our results may not generalize to all novice nurses populations. Despite this limitation, our findings are consistent with previous simulation research regarding novice nurses' self-efficacy. The second limitation is that we had a small sample size and limited power to detect statistically significant differences between groups. Despite this limitation, we conducted a rigorous pilot trial with a three-arm design to test our expert modeling intervention and reached statistical significance.

Implications for Nursing Education

This pilot randomized control trial makes a significant contribution to nursing education with evidence for using expert modeling videos and voice over PowerPoint as simulation preparation. Both types of simulation preparation increase novice nurses' self-efficacy above and beyond the effect of reading assignments commonly used as simulation preparation. Consideration of the temporary nature of self-efficacy is important, as self-efficacy should not be a surrogate for other educational outcomes. Rather, self-efficacy represents an important step towards behavioral change. Findings from this pilot study indicate that expert modeling and voice over PowerPoint are more effective than other methods of simulation preparation to increase novice nurses' self-efficacy for the complex task of managing multiple patients in an acute care setting. Given the evolving climate of healthcare and increasing demands on novice nurses today, it is important to evaluate interventions that increase novice nurses' self-efficacy alongside other educational outcomes.

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Chapter VI — ASSOCIATION OF CHANGE IN COMPETENCE AND SELF-EFFICACY AFTER A MULTIPLE PATIENT SIMULATION RCT

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This manuscript replaces aspects of traditional methods and results chapters. Ashley Franklin was the primary author on this paper and conducted the analysis under the direction of Dr. Lee during her tenure at OHSU. Drs. Tanner, Gubrud-Howe and Sideras contributed to conception and design. Dr. Lee was the senior author on this paper. This paper will be submitted to *Clinical Simulation in Nursing*, an indexed and peer-reviewed journal with a larger readership of those interested in simulation, as a short communication and will be submitted after the dissertation defense.

The Institutional Review Board determined that this study was exempt.

Abstract

Background: The relationship between competence and self-efficacy for novice nurses in simulation is not well documented.

Methods: This pilot randomized control trial evaluated the impact of three simulation preparation methods on improving competence and self-efficacy to provide care for multiple patients. Both competence and self-efficacy were measured at baseline and after a five week intervention. We used parametric and nonparametric correlations on change in competence and self-efficacy scores.

Results: Twenty novice nurses participated in the trial. There was no relationship between change in competence and change in self-efficacy.

Conclusions: The change in competence and self-efficacy scores after multiple patient simulation are statistically independent of each other.

Background

Much work has been done to establish that simulation is effective at increasing novice nurses self-efficacy, and a recent meta-analysis clarified that a precise estimate of the positive influence of simulation on self-efficacy can be made (Franklin & Lee, in press). Therefore, there is no longer a need to measure self-efficacy as a stand-alone outcome of simulation research. However, there has been a recent call for research about the relationship between competence and self-efficacy of pre-licensure novice nurses and how the relationship evolves over time (Kardong-Edgren, 2013).

Our pilot randomized control trial explored the relationship between competence and self-efficacy in the context of multiple patient simulation. We measured novice nurses' competence and self-efficacy for providing care to multiple patients among three simulation preparation groups (expert modeling/intervention, voice over PowerPoint/active control, and reading assignments/passive control). Results of the trial were reported elsewhere (Franklin, Sideras, Tanner, Gubrud-Howe, & Lee, 2014b; Franklin, Tanner, Gubrud-Howe, Sideras, & Lee, 2014c). The aim of this paper is to report findings for the correlation between change in competence and self-efficacy among a sample of 20 senior undergraduate novice nurses from a university in the Pacific Northwest region of the United States.

Methods

We performed parametric and nonparametric correlations on change in competence and self-efficacy scores. Our Institutional Review Board classified this study as exempt.

Measurement

Competence was measured by two blinded raters using the Creighton Simulation Evaluation Instrument™ (CSEI; Todd, Manz, Hawkins, Parsons, & Hercinger, 2008) while watching multiple patient simulation live from a control room. The CSEI is a 22 item rater-observation measure of competence with dichotomous response options. The CSEI has been used previously with multiple patient simulation research (Frontiero & Glynn, 2012). Scores are calculated by summing responses, and higher scores on the CSEI represent increased competence.

Additionally, we measured self-efficacy using a modified National League for Nursing Student Satisfaction and Self-Confidence in Learning scale (SCLS; Jeffries & Rizzolo, 2006). We used a seven item subscale of the SCLS after performing psychometric testing (Franklin, Burns, & Lee, 2014a). The SCLS measures novice nurses' self-efficacy for skills practiced in simulation. Scores are calculated by summing responses, and higher scores represent increased self-efficacy.

Analysis

Standard descriptive statistics of frequency, central tendency, and dispersion were used to describe the sample using StataMP v.13 (College Station, Texas). We used parametric and nonparametric correlations to explore the relationship between change in competence and self-efficacy scores. Further, we used linear regression to adjust the correlation for group assignment.

Results

Twenty novice nurses participated in the trial. Demographic characteristics of the participants and study groups are available in **Table 6.1**. Results of the competence change scores and self-efficacy change scores were previously published (Franklin et al., 2014b, 2014c). There was no association between change in competence scores and self-efficacy scores if we considered raw scores or relative change compared to baseline evaluation (**Table 6.2**). Using linear regression to adjust for intervention group, there was no relationship between change in competence and self-efficacy scores.

Variables	Randomization group			p value
	Reading n (%)	Voice Over PowerPoint n (%)	Expert Modeling n (%)	
n	6	7	7	
Gender, Female	3 (50)	7 (100)	6 (85.7)	0.01*
Age,				
22-26	4 (66.7)	2 (28.6)	4 (57.1)	0.25
27-32	-	2 (28.6)	2 (28.6)	
33-38	2 (33.3)	3 (42.9)	1 (14.3)	
Race,				
Caucasian	4 (66.7)	7 (100)	6 (85.7)	<0.01*
Ethnicity,				
Non-Hispanic or Latino	5 (83.3)	7 (100)	7 (100)	<0.01*
Previous Degree	2 (33.3)	3 (42.9)	4 (57.1)	0.66
Previous Work in Healthcare,	4 (66.7)	5 (71.4)	3 (42.9)	0.04*
CNA	1 (16.7)	1 (14.3)	2 (28.6)	
Learning Style Preference,				
Read/Write	1 (16.7)	-	1 (14.3)	<0.01*
Kinesthetic	5 (83.3)	7 (100)	6 (85.7)	
Mean Hours Worked/Week	14.8	14.3	12	0.90

Table 6.1. Demographics.

	Raw Change	Relative Change
Pearson's <i>r</i>	0.12	-0.08
	p= 0.614	p= 0.741
Spearman's rho	0.14	0.08
	p= 0.547	p= 0.740
Standardized Beta	0.05	-0.07
	p= 0.856	p= 0.792

Table 6.2. Change in competence and self-efficacy scores. Beta represents correlation derived through linear regression adjusted for group assignment.

Discussion

Simulation is widely used in nursing education to increase novice nurses' competence and self-efficacy. This is the first trial to explore the relationship between competence and self-efficacy of novice nurses and how the relationship evolves over time in the context of multiple patient simulation. Findings from this pilot randomized control trial of 20 senior pre-licensure novice nurses indicate that there is no relationship between change in competence and self-efficacy scores.

Our findings correspond with previous simulation research with novice nurses where there was no correlation between competence and self-efficacy scores in a crisis response scenario (Baxter & Norman, 2011; Liaw, Scherpbier, Rethans, & Klanin-Yobas, 2012). Additionally, nurse educators have similar findings measuring competence and self-efficacy after pediatric simulation (Lambton, O'Neill, & Dudum, 2008). Moreover, there is evidence that medical fellows' self-assessment and competence for communication skills involved in a simulated family meeting also lack a linear relationship (Calhoun, Rider, Meyer, Lamiani, & Truog, 2009). Several groups of researchers have found that novice health professionals with high self-efficacy have low

scores on externally derived measures of competence (Eva, Regehr, & Gruppen, 2012; Kardong-Edgren, 2013).

It seems important to consider methodological limitations that could influence the lack of a relationship. First, correlation coefficients are very sensitive to outliers, so previous correlation studies with sample sizes less than 50 are not robust enough to detect a relationship. Second, use of researcher-developed scales without acceptable psychometric properties likely contributes to measurement bias. Finally, use of non-experimental methods is most cumbersome when results represent cross-sectional data exclusively.

Our pilot randomized control trial is unique because we used measures of competence and self-efficacy with supporting psychometric evidence (Adamson et al, 2011; Franklin et al., 2014a; Parsons et al., 2012). Further, we incorporated simulation preparation interventions and used simulation as a platform for measuring competence; this work lays a foundation for the understanding of how interventions improve novice nurses' competence and self-efficacy. Additionally, this correlation study using change scores makes a novel contribution to the literature that is well aligned with research priorities to evaluate the trajectory of change between novice nurses' competence and self-efficacy over time (Kardong-Edgren, 2013).

Findings of no correlation between change in competence and self-efficacy scores among novice nurses are somewhat surprising because there is evidence that self-efficacy is a strong predictor of behavioral change in clinical nursing research (Lenz & Shortridge-Baggett, 2002). Our pilot randomized control trial used Social Cognitive

Theory (Bandura, 1986) as a framework and expert modeling videos as an intervention. Some have suggested that Social Cognitive Theory may use competence as an outcome prematurely with novice nurses participants; in particular, Kardong-Edgren (2013) recommended coupling Bandura's theory with a Deliberate Practice framework (Ericsson, 2004) to allow for novice nurses' continued learning and assessment of a competence trajectory over time. Coupling the frameworks in nursing education research could meet the need for exploring the relationship between competence and self-efficacy in the future.

Analysis of the relationship between change in competence and self-efficacy is interesting given recent attention to the role of novice healthcare providers' self-assessment. *The Essentials of Baccalaureate Education* and the *Outcomes Project* both call for novice healthcare providers to focus on self-assessment as an element of lifelong learning (Accrediting Council for Graduate Medical Education, 2009; American Association of Colleges of Nursing, 2008). Yet, there is evidence of a gap between the way novice healthcare providers assess their own performance compared to assessment of novices by experienced faculty (Eva et al., 2012). The tension between faculty assessment and novices' self-assessment might lead individuals to prioritize which type of assessment is more important. However, our findings suggest that faculty assessment of competence and novice nurses' self-assessment are not related. Thus, one cannot be used as a surrogate for the other.

Strengths and Limitations

The first limitation of this pilot study is that we selected a convenience sample from one university. As such, the sample may underrepresent some groups based on age, gender or race. Findings from this pilot study could be different if students from other campuses were included in data collection. Thus, our results may not generalize to all novice nurse populations. Despite this limitation, our findings are consistent with previous correlation studies of novice nurses' competence and self-efficacy in simulation. The second limitation is that we had a small sample size that increased the likelihood that outliers affected our correlation coefficient. Despite this limitation, we explored the relationship between change in competence and self-efficacy scores using parametric and nonparametric correlations.

Conclusion

This pilot randomized control trial makes a significant contribution to nursing education research as the first to explore the relationship between competence and self-efficacy of senior undergraduate novice nurses and how the relationship evolves over time in the context of multiple patient simulation. In this trial, change in competence and self-efficacy were statistically independent. There is a need for ongoing research with large samples, valid and reliable instruments, experimental designs, and a Deliberate Practice framework to further explore the relationship between competence and self-efficacy.

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Chapter VII — SUMMARY AND CONCLUSIONS

This chapter is similar to the discussion chapter of a traditional dissertation, with the exception that it will address themes across manuscripts and expand on some areas that were not addressed in previous chapters due to publication constraints.

Introduction

Novice nurses — those who are in school or have practiced as a nurse for fewer than six months (Benner, Tanner, & Chesla, 2009) — comprise more than 10 percent of hospital staff nurses (Nursing Executive Center, 2007). More than 100,000 novice nurses completed basic nurse training programs in 2008 (National League for Nursing, 2008). It is a significant problem for patients receiving nursing care that novice nurses make more errors than experienced nurses (Committee on Quality of Health Care in America, 2001; del Bueno, 2005; Ebright, Urden, Patterson, & Chalko, 2004; Ironside, Jeffries, & Martin, 2009; Institute of Medicine, 2000, 2003; National Council of State Boards of Nursing (NCSBN), 2007; Saintsing, Gibson, & Pennington, 2011; Smith & Crawford, 2003). Between 2005 and 2008, descriptive studies of novice nurses revealed that 50 percent of novice nurses would fail to recognize a life-threatening complication in a physical assessment (del Bueno, 2005). More than 40 percent of novice nurses reported making medication errors (Ebright et al., 2004; NCSBN, 2007; Smith & Crawford, 2003). Furthermore, 37 percent of novice nurses reported errors related to delays in treatment (Smith & Crawford). Therefore, it is quite clear that novice nurses' errors in practice and of omission can have significant impact of patient outcomes.

Most often noted as being problematic for novice nurses is their inability to manage multiple responsibilities and anticipate changes in their patients' conditions (Berkow, Virkstis, Stewart, & Conway, 2008). Novice nurses' concrete, rule-based thinking (Benner et al., 2009) and low self-efficacy (Ebright et al., 2004) likely contribute to their errors. Thus, nurse educators in both academic and practice settings favor

simulation as a teaching strategy because it fosters adaptive thinking. By participating in a series of simulations, novice nurses may better recognize their own competence (Sportsman, Schumacker, & Hamilton, 2011). Simulation also increases novice nurses' self-efficacy (Franklin & Lee, in press), which may lead to improvement in competence. Therefore, multiple stakeholders including nursing faculty, hospital employers, and the National Council of State Boards of Nursing (NCSBN) are interested in how programs of simulation shape novice nurses' competence.

In order to fill existing gaps in simulation research and provide a preliminary evidence base for pre-simulation interventions, the overarching purpose of this body of research was to increase our understanding of how various simulation preparation methods enhance novice nurses' competence and increase self-efficacy. The specific aims of this program of research were to 1) synthesize what is known about the influence of simulation on self-efficacy, 2) quantify the psychometric properties of three National League for Nursing (NLN) simulation evaluation scales, 3) compare the efficacy of expert modeling videos with voice over PowerPoint and traditional reading assignments on novice nurses' competence for providing care to multiple patients, 4) compare the efficacy of expert modeling versus active and passive controls on novice nurses' self-efficacy for providing care to multiple patients, and 5) explore the relationship between change in competence and self-efficacy after multiple patient simulation. Each specific aim was addressed, generating new knowledge that will contribute to findings from extant nursing education research. General inferences that can be drawn from this body of research will serve as evidence to support the use of expert modeling videos and voice

over PowerPoint as pre-simulation assignments to influence novice nurses' competence and self-efficacy. Further, findings from this body of research will provide guidance for multiple future programs of research as well as simulation programs in both academic and practice settings. This final chapter begins with a summary of principal findings for each specific aim. Selected themes that warrant additional discussion are then expounded upon. This chapter concludes with recommendations for future research and for the practice of nursing education.

Summary and Principal Findings

Simulation Improves Self-Efficacy

To address the first specific aim of this body of research, a detailed review and random-effects meta-analysis of 43 published studies reporting the influence of simulation on self-efficacy was performed. The vast majority of novice nurses agree that simulation increases self-efficacy. Most importantly, simulation increased self-efficacy more than lecture among comparison studies employing experimental designs. Regarding data on self-efficacy improvement with simulation, there were two principal findings (**Table 7.1**). First, simulation had a large impact on novice nurses' self-efficacy among studies with a one group, pre-posttest design. Second, the estimate of the effect of simulation on novice nurses' among studies with experimental designs was precise and statistically significant. Among studies where conclusions about the impact of simulation on self-efficacy were imprecise, methodological issues interfered with statistical synthesis.

Table 7.1. Principal Findings: Specific Aim 1

Specific Aim 1: Synthesize what is known about the influence of simulation on self-efficacy.

Study	Principal Findings
Effectiveness of Simulation for Improvement in Self-Efficacy Among Novice Nurses: A Meta-Analysis	<ol style="list-style-type: none"> <li data-bbox="876 430 1430 598">1) Simulation improved self-efficacy in one group, pre-posttest studies (Hedge's $g = 1.21$ (95% CI 0.63 to 1.78); $p < 0.001$). <li data-bbox="876 630 1430 867">2) Simulation also was favored over control teaching interventions for improving self-efficacy in studies with experimental designs (Hedge's $g = 0.27$ (95% CI 0.1 to 0.44); $p = 0.002$).

Conclusions from this analysis contribute significantly to the field of nursing education research. First, this study represents the first quantitative synthesis of the impact of simulation on improving novice nurses' self-efficacy. In the last three years, meta-analytic techniques have been used to examine simulation outcomes for broad topics like knowledge, skills and behaviors (Cook et al., 2011; Ilgen, Sherbino, & Cook, 2013; Kennedy, Maldonado, & Cook, 2013; Lorello, Cook, Johnson, & Brydges, 2013; Mundell, Kennedy, Szostek, & Cook, 2013) with mixed groups of healthcare providers; but, the effect of simulation on novice nurses' self-efficacy has not been quantitatively synthesized. Second, the findings represent a clear relationship between simulation and increased self-efficacy for novice nurses. Therefore, future research involving self-efficacy as an exclusive outcome of simulation among novice nurses will be unlikely to contribute any new knowledge. Rather, it is more appropriate to measure self-efficacy with other outcomes of interest like observed competence. Moreover, trajectories of

change in self-efficacy, as opposed to cross-sectional or uncorrelated serial assessments, should be the focus of research on simulation among novice nurses.

Based on this analysis, there are two formal recommendations, which reflect an interest in moving forward the science of simulation research. First, it is imperative that researchers use previously validated self-efficacy tools and not create their own, as this is unnecessary and contributes to an inability to synthesize the relationship between simulation and self-efficacy. Second, the only way to advance the science is to use experimental methods to compare the effect of simulation versus another teaching strategy. The clearest signal of the influence of simulation on self-efficacy came from our analyses of experimental studies. Such clear signals aide design decisions for future trials.

Psychometric Properties of the NLN Student Satisfaction and Self-Confidence in Learning, Simulation Design Scale, and Educational Practices Questionnaire

The second specific aim of this body of research was to quantify the psychometric properties of three commonly used simulation evaluation instruments. To address this aim, confirmatory and exploratory factor analyses were performed along with assessments of concordant and discordant validity, item discrimination, and internal consistency. It was formally hypothesized that all three of the NLN measures would have acceptable reliability and validity for use in educational research (**Table 7.2**). Findings from this study indicate that all three instruments are both reliable and valid, though there is room for improvement in construct validity. These instruments have been widely used to evaluate simulation outcomes both in research and education settings, but this analysis revealed that the instruments measure concepts that are closely related. By providing

such evidence, the results of this analysis make a meaningful contribution to the field of nursing education research. That is, researchers can have increased confidence in using only one of these instruments as a parsimonious measurement strategy in future simulation research. If researchers choose to continue to use all three instruments, then the recommendation from this body of research is to be aware of the strong statistical relationship across instruments before making conclusions about underlying concepts.

Findings related to construct validity of the Student Satisfaction and Self-Confidence in Learning scale (SCLS) are also meaningful in moving forward the science of measuring self-efficacy. Specifically, factor analysis confirmed the validity of using the self-confidence subscale independently. Not only did the results of this analysis shape the remainder of this body of research, but they set the stage for future research about the trajectory of novice nurses' self-assessment over time. In a research environment that previously focused on measuring novice nurses' satisfaction with simulation and identifying elements of simulation that promote satisfaction, this forward-looking perspective of measuring novice nurses' self-confidence for delivering nursing care will likely generate multiple programs of research.

Table 7.2. Principal Findings: Specific Aim 2

Specific Aim 2: Quantify the psychometric properties of the three NLN simulation evaluation instruments.

Study	Principal Findings
Psychometric Testing on the NLN SCLS, SDS, and EPQ Using a Sample of Pre-Licensure Novice Nurses	<ol style="list-style-type: none"> 1) Construct validity on the SCLS improved by omitting item 13 and allowing item 9 to double load on two subscales (RMSEA=0.10, CFI=0.99, TLI=0.98, WRMR=1.66, $\chi^2=656.05$, $p<0.01$). 2) Construct validity on the SDS improved by allowing items 5 and 17 to double load on two subscales (RMSEA=0.06, CFI=0.99, TLI=0.98, WRMR=1.13, $\chi^2=779.96$, $p<0.01$). 3) The SCLS had poor discordant validity with the SDS ($r=0.66$, $p<0.01$) and EPQ ($r=0.72$, $p<0.01$).

Note: NLN = National League for Nursing, SCLS = Student Satisfaction and Self-Confidence in Learning, SDS = Simulation Design Scale, EPQ = Educational Practices Questionnaire. Desired results for a χ^2 significance test of model fit are close to zero and nonsignificant. Desired results for the CFI and TLI, are 0.95 or greater. Desired results for RMSEA and are less than or equal to 0.05. Desired results for WRMR are < 0.9 .

Expert Modeling Increases Novice Nurses' Competence

The third specific aim of this body of research was to compare the efficacy of three simulation preparation methods on novice nurses' competence for providing care to multiple patients in simulation. To address this aim, a three group randomized control trial was performed. It was formally hypothesized that novice nurses in the expert modeling group would have a greater increase in competence than their peers in other

simulation preparation groups. The net effect of expert modeling videos on novice nurses' competence was as expected. Further, change in competence scores was greater with both the expert modeling and voice over PowerPoint methods compared with reading assignments that represent "usual care" in contemporary nursing simulation (**Table 7.3**). Expert modeling videos had the greatest influence on improving novice nurses' competence for delegation and safety checks. Although expert modeling has been proposed previously as a beneficial influence on novice nurses' competence (Aronson, Glynn, & Squires, 2013; Johnson et al., 2012; LeFlore, Anderson, Michael, Engle, & Anderson, 2007), these results were the first empirical evidence of the additive benefit of expert modeling compared other active teaching strategies like voice over PowerPoint. These results are quite easy to communicate and therefore more likely to be translated into nursing education practice.

Table 7.3. Principal Findings: Specific Aim 3

Specific Aim 3: Compare the efficacy of three simulation preparation methods on novice nurses' competence for providing care to multiple patients in simulation.

Study	Principal Findings
Comparison of Expert Modeling Versus Voice Over PowerPoint and Pre-Simulation Readings on Novice Nurses' Competence for Providing Care to Multiple Patients	1) ANOVA results for raw change in competence scores between groups were not significant, $F(2, 17)=0.29$, $p=0.75$, eta-squared 0.03. 2) The expert modeling (Cohen's $d=0.41$) and the voice over PowerPoint groups (Cohen's $d=0.23$) had the greatest increase in competence compared with reading assignments.

Two elements of this study design contribute significantly to the literature surrounding novice nurses' competence for managing multiple patients. First, this study was the first to incorporate expert modeling as simulation preparation. Second, the research design incorporated repeated exposure to the intervention over the course of an academic term. That is, use of the Sakai learning management system both allowed for and documented how often novice nurses engaged with the intervention materials. In this body of research, novice nurses who watched the expert modeling videos once or twice demonstrated a desirable change in behavior. To further increase the effect of expert modeling, future research could incorporate a Deliberate Practice framework (Ericsson, 2004) and additional hands-on practice in the simulation lab. These existing design elements and recommendations are closely aligned with research priorities related to educational measurement and evaluation (National League for Nursing, 2012) and will likely contribute to multiple programs of research.

Expert Modeling and Voice Over PowerPoint Increase Novice Nurses' Self-Efficacy

The fourth specific aim of this body of research was to compare the efficacy of three simulation preparation methods on novice nurses' self-efficacy for providing care to multiple patients in simulation. To address this aim, a three group randomized control trial was performed. It was formally hypothesized that the expert modeling method would promote greater improvement in self-efficacy compared to the voice over PowerPoint and reading assignment simulation preparation methods (**Table 7.4**).

Table 7.4. Principal Findings: Specific Aim 4

Specific Aim 4: Compare the efficacy of three simulation preparation methods on novice nurses' self-efficacy for providing care to multiple patients in simulation.	
Study	Principal Finding
Effectiveness of an Expert Modeling Intervention on Novice Nurses' Self-Efficacy in Multiple Patient Simulation	1) When the expert modeling and voice over PowerPoint groups were combined, there was a significant difference in self-efficacy compared to the reading group, $t(18)=3.08$, $p=0.003$, Cohen's $d=1.501$.

This research provided an original perspective on novice nurses' self-efficacy in the context of multiple patient simulation. Findings from this analysis were as expected in terms of change in self-efficacy scores relative to baseline assessment. These results reveal significant improvements in self-efficacy when the expert modeling and voice over PowerPoint groups were combined for further analysis and compared to the reading group as a passive control.

In addition to the specific research priorities put forth, an implicit research question emerged from this analysis. That is, the relationship between change in self-efficacy and change in competence scores among novice novices was not well documented in the simulation literature. According to Social Cognitive Theory, possessing high self-efficacy leads to competent behavior (Bandura, 1986). Thus, change in self-efficacy was presumed to be related to change in competence; but, there was little empirical evidence to support this assumption. Thus, the next step was to test the relationship between change in self-efficacy and change in competence in the context of multiple patient simulation.

Self-Efficacy and Competence After Simulation Are Not Associated

The fifth aim of this body of research was to explore the relationship between change in self-efficacy and competence after multiple patient simulation. To address this aim, parametric and nonparametric correlations between raw and relative change in self-efficacy and competence were performed. This analysis was innovative because it encompassed the change in self-efficacy and competence related to targeted simulation preparation interventions. It was hypothesized that improvements in self-efficacy would relate to improvements in competence. However, findings from this analysis did not support the hypothesis. In fact, there was no significant relationship detected between change in self-efficacy and competence scores in the context of multiple patient simulation (**Table 7.5**).

Table 7.5. Principal Findings: Specific Aim 5

Specific Aim 5: Explore the relationship between change in self-efficacy and competence after multiple patient simulation.

Study	Principal Finding
Association of Change in Self-Efficacy and Competence After a Multiple Patient Simulation RCT	1) There was no association between change in self-efficacy and competence if we considered raw scores ($r=0.12$, $p= 0.61$) or relative change compared to baseline assessment ($r= -0.08$, $p= 0.74$).

Further analysis of the relationship between self-efficacy and competence also revealed no association at either the baseline or posttest assessment; similarly, there was no relationship detected between self-efficacy and competence within the expert modeling, voice over PowerPoint, or reading assignment groups.

Improvements in self-efficacy have been negatively associated with competence in previous education research (Eva, Regehr, & Gurppen, 2012; Kardong-Edgren, 2013), but this analysis makes a meaningful contribution to the field because it addresses change in both self-efficacy and competence over time. Because change in self-efficacy and competence are not statistically related, researchers should continue to measure both concepts in the future. For novice nurses, change in self-efficacy and competence scores are complimentary but not overlapping. The most important implication of these findings is how they will inform future studies that trend changes in self-efficacy and competence over time.

Overall, the results of this body of research serve as a significant contribution to nursing education research. Namely, there is now evidence that a) simulation positively influence novice nurses' self-efficacy, b) three commonly used measures of simulation outcomes have acceptable psychometric support for reliability and validity, c) expert modeling increases novice nurses' competence more than voice over PowerPoint and reading assignments, d) both expert modeling and voice over PowerPoint increase novice nurses' self-efficacy for providing care to multiple patients, and e) change in self-efficacy and competence scores are not statistically related in the context of multiple patient simulation. Moreover, the results of this body of research have revealed more unanswered questions and provided direction for future work.

Continued Discussion on Selected Themes

Competence

Much attention has been given to novice nurses' competence and teaching strategies to increase it since publication of *The Future of Nursing* (Institute of Medicine, 2011). Nurse educators have focused on transforming education practices to increase quality, limit nonessential content, and use effective pedagogies to increase competence (Benner, Sutphen, Leonard, & Day, 2010). Past research and other types of scholarship have led to significant contributions to the understanding of competence in nursing (Allen, Ramaekers, & van der Velden, 2005; Benner, 1982; Cronenwett et al., 2007; del Bueno, 1990; Eraut, 1994; Short, 1984; While, 1994); but, this current body of research represents a novel paradigm for testing the influence of expert modeling videos against other simulation preparation methods to enhance novice nurses' competence in the context of a complex multiple patient simulation.

Measuring competence in nursing is a challenge related to diverse settings of practice (Institute of Medicine, 2011) and the transactional nature of nursing care (Benner, 1982). Yet, a present research strategy put forth by the National League for Nursing (2012) is to link simulation with graduate nurse competence. By testing an expert modeling intervention against both active and passive pedagogies and making causal inferences from a well-designed, pilot randomized control trial, this body of research is an example of the future direction of nursing education science. Instead of viewing simulation exclusively as a teaching strategy, under this paradigm simulation is a platform through which researchers can understand the influence of expert modeling and

other simulation preparation methods on novice nurses' competence and other related outcomes. It is generally accepted that simulation increases novice nurses' competence; but, continued research is needed to further explore how expert modeling and other simulation preparation methods further increase competence and therefore narrow the gap between education and nursing practice.

Performance Measures

More research is also needed to validate performance measures used to evaluate competence. The Institute of Medicine (2011) acknowledged the need to identify or develop performance measures to ensure that nurses have acquired the full range on competence required for practice. The Creighton Simulation Evaluation Instrument™ (CSEI) used in this body of research has been widely incorporated into nursing education since 2010 (Hayden, Jeffries, & Kardong-Edgren, 2012; Rizzolo, 2012) and recognized for including elements like physical assessment, communication, decision-making, and technical skills. This body of research established a high standard for interrater reliability using the CSEI in multiple patient simulation; yet, more research is needed to unravel the numerical differences — those differences between raters and differences between pre- and posttest assessments — that represent a level of educational and clinical significance in nursing. This type of research on novice nurses' competence will no doubt contribute substantially to extant nursing education knowledge.

Because competence in nursing is task specific, the most important thing to consider when choosing a performance measure is the context for which it has been validated. All performance measures need to consider both the characteristics of a task

and the way in which raters will quantify performance. Performance measures can be general, such as the Lasater Clinical Judgment Rubric (Lasater, 2007), or specific. The CSEI is a specific measure with detailed expectations for each task; the specificity requires a fair amount of rater training to improve interrater reliability (Parsons et al., 2012). Whether the performance measure is general or specific, researchers must appreciate the number of tasks presented in simulation. We tend to be preoccupied with evaluation of competence and only look at nurses' performance on a few problems, when it is more effective to evaluate competence using multiple, short clinical reasoning problems (Norman, 2005). For this reason, our research team appreciated the breadth of elements presented in the CSEI and opportunities to use the measure for multiple simulation patients. Moreover, it is most defensible to choose a valid and reliable performance measure and use it repeatedly with several simulation patients and on multiple occasions to evaluate nurses' competence.

It is important to recognize that decisions related to performance measures influence conclusions drawn about competence. In this body of research, novice nurses' performance in simulation represented competence, and findings primarily related to differences in behavior across groups and over time. This approach did not provide specific information about novice nurses' competence for decision-making that was "thinking" and not "doing," however other pedagogies like case studies would accomplish this aim. Nurse scientists interested in measuring competence should consider the tradeoffs of "thinking" versus "doing," weigh the importance of approximating reality in simulation, and think about opportunities for using narrative accounts which provide

more information about novice nurses' emotional competence. There is no evidence that simulation, case studies, or narrative accounts are superior to one another in terms of measuring competence or decision making. Rather, the tradeoffs of different approaches affect conclusions that researchers make about novice nurses' competence. More research is needed comparing and contrasting these approaches to measuring novice nurses' competence.

Expert Modeling

Healthcare professionals and educators from medicine (Zhang & Chawla, 2012), nursing (Aronson et al., 2013; Guhde, 2010; Johnson et al., 2012; LeFlore et al., 2007; McConville & Lane, 2006), and allied health (de Godoy, Costa Mendes, Hayashida, Nogueira, & Marchi Alves, 2004; Selle, Salamon, Boarman, & Sauer, 2008) report that expert modeling videos have a positive impact on competence. This body of research adds to the extant literature by comparing the efficacy of expert modeling videos against other simulation preparation methods to increase competence. Elements of expert modeling that make the largest impact on novice healthcare providers are as of yet unknown. Therefore, continued research is needed to compare the efficacy of expert modeling videos focused on process of care delivery with videos focused on patient-specific content. Further, competence and self-efficacy have been common research outcomes after expert modeling video interventions; exactly how expert modeling videos influence the delivery of patient-centered care has not yet been explored. These areas for future research are described below.

Modeling process versus content. Regarding the influence of expert modeling videos on novice nurses' competence, our video intervention was more effective at increasing competence for certain domains, like delegation and performing safety checks (Franklin, Sideras, Tanner, Gubrud-Howe, & Lee, 2014). In this body of research, expert modeling videos focused on process of care delivery, including closed loop communication to unlicensed assistive personnel as well as performing safety checks like identifying the patient and looking at the concentration and infusion rate of medications hanging on an intravenous pump. Reflecting on our expert modeling video intervention, it seems these skills for delegation and safety checks transfer easily to delivering nursing care to patients with a large variety of admitting diagnoses. Effect size estimates comparing expert modeling with the reading assignment method of simulation preparation were considered small effects as per Cohen (Cohen, 1988). Yet, the expert modeling video intervention increased novice nurses' competence for delegation and safety checks more than the voice over PowerPoint or reading assignment methods.

In contrast, expert modeling videos were not as effective at increasing novice nurses' competence for performing focused assessments or priority setting. One potential explanation for this inconsistency in the effect of expert modeling videos relates the underlying knowledge about patient-specific content required for novice nurses to individualize care in the form of focused assessments and priority setting. That is, both focused assessments and priority setting require novice nurses to have basic knowledge related to a patient's admitting diagnosis that enables them to identify pertinent assessments and nursing priorities. For example, novice nurses provided care for a

cardiac patient experiencing chest pain in our multiple patient simulation. One of the priority setting categories related to patient teaching and goal setting that the chest pain would be totally resolved. Novice nurses' lack of familiarity with administering nitroglycerin was a limitation in simulation. Thus, it seems appropriate to investigate if expert modeling videos focused on patient-specific content would be effective to increase novice nurses' competence for performing focused assessments and priority setting. This novel line of inquiry lays a foundation for further research comparing three expert modeling groups in a fully-powered randomized control trial to test the efficacy of 1) expert modeling videos focused on process of care delivery against 2) videos focused on patient-specific content and 3) a combination of both process-focused and patient-specific expert modeling videos.

Expert modeling and patient-centered care. An additional area for future research relates to how expert modeling influences novice nurses' ability to deliver patient-centered care. As patient-centered care incorporates coordination of care, listening and communication skills, patient education, and development of nurse-patient partnerships (American Association of Colleges of Nursing (AACN), 2008), it requires a level of patient attunement and ethical comportment that characterize *good* nursing practice (Benner et al., 2009). More research is needed to examine how expert modeling videos — through exemplars of technical, behavior, and cognitive skills applied by an expert (LeFlore et al., 2007) — influence novice nurses' delivery of patient-centered care. One presumption is that expert modeling videos can equip novice nurses' with organizational strategies and “an ability to recognize qualitative distinctions” that

characterize expert nursing practice (Benner et al., p. 158). In this body of research, post hoc analysis revealed that effect sizes were larger for patient-centered care than for other previously described domains, like delegation and safety checks (**Table 7.6**).

Table 7.6. Effect Size Comparison of Expert Modeling to Voice Over PowerPoint

Patient-Centered Care	0.559
Delegation	0.419
Safety Checks	0.241
Priority Setting	0.111
Focused Physical Assessment	-0.154

Thus, the potential for expert modeling videos to increase novice nurses' delivery of patient-centered care represents an outcome that is meaningful in both academic and practice settings. Incorporating patient-centered care as an outcome of expert modeling research will certainly add to extant nursing knowledge.

Self-Efficacy as a Type of Self-Assessment

According to the theoretical underpinnings of this body of research, expert modeling has a positive influence on self-efficacy. This supposition was based on seminal research (Bandura, 1977) and more recent empirical testing (Guhde, 2010; Johnson et al., 2012; Zhang & Chawla, 2012) providing evidence that expert modeling also positively influences competence. By theoretical definition, self-efficacy is an antecedent to competence (Bandura & Schunk, 1981). However, recent self-efficacy research in simulation with novice nurses has revealed that self-efficacy is not related to competence (Baxter & Norman, 2011; Lambton, O'Neill, & Dudum, 2008; Liaw, Scherpbier, Rethans, & Klanin-Yobas, 2012). In this body of research, there was no relationship between change in self-efficacy and change in competence. That is, change in self-

efficacy and change in competence were independent. Moreover, change in self-efficacy and change in competence informed different elements of novice nurses' practice.

Recently, educational researchers from nursing and medicine have critiqued self-efficacy under the umbrella of self-assessment because of incongruence between novice healthcare providers' self-assessment compared to objective assessments of competence (Eva et al., 2012; Kardong-Edgren, 2013). This body of work informs future research by measuring trajectories of change in self-efficacy and competence in the context of a complex multiple patient simulation. Additional research is needed to investigate how expert modeling combined with other interventions that increase self-efficacy (e.g. verbal feedback and repeated opportunities for practice in simulation) may resolve the incongruence between novice nurses' self-assessment compared to objective assessments of competence.

Learning Theories to Support Novice Nurses

This body of research used Social Cognitive Theory as framework for designing the expert modeling intervention and measurement in simulation. Social Cognitive Theory fits well with simulation because it encompasses the learning environment, cognitive process, and behaviors demonstrated (Bandura, 1986). Additionally, the expert modeling element of Social Cognitive Theory fosters novice nurses' salience for both "thinking" and "doing," thereby providing training for behavior change. Yet, critics of Social Cognitive Theory assert that it lacks attention to the ongoing process of maintaining competence after initial behavior change (Kardong-Edgren, 2013). Therefore, future simulation research should incorporate elements of a Deliberate Practice

framework that provide novice nurses with multiple opportunities to improve both “thinking” and “doing” by performing the same or similar tasks repeatedly and receiving immediate feedback on their performance (Ericsson, 2004). Such deliberate efforts to foster behavior change allow novice nurses to refine their individual practice over time (Ericsson, Whyte, & Ward, 2007).

Feedback provided from peers and from expert nurses immediately after a simulation makes the learning process more social, but it also incorporates the immediacy and engagement elements of Adult Learning Theory. Further, feedback from peers helps tap into previous life experiences that novice nurses bring to their undergraduate education (Knowles, 1989). For the last 10 years, best practices in simulation have called for nurse educators to design simulation based on Adult Learning Theory tenants such as feedback, mutual respect and psychological safety (Gloe et al., 2013; Jeffries, 2005), but there is a gap in the literature related to how feedback directly impacts behavior change. Future research combining the elements of expert modeling with feedback from peers and expert nurses will add to simulation science.

Delegation

Nursing leaders in practice settings report low levels of satisfaction with novice nurses’ delegation skills (Berkow et al., 2008). Yet, *The Essentials of Baccalaureate Education* identifies that baccalaureate-prepared graduate nurses will have the knowledge and authority to delegate tasks, supervise and evaluate other healthcare personnel upon completion of their training (AACN, 2008). Anecdotal evidence from undergraduate novice nurses suggests they do not have adequate practice with delegation in traditional

hospital-based clinical experiences and often choose not to delegate tasks in order to take advantage of opportunities for hands-on skill practice. Thus, providing opportunities for delegation in simulation seems to encourage novice nurses to practice delegation skills while still allowing them to perform vital signs, blood glucose readings, and activities of daily living with actual patients in the clinical setting.

This body of research highlights opportunities for delegation practice in the context of multiple patient simulation where novice nurses genuinely need help with managing multiple tasks at the beginning of shift. In this pilot randomized control trial, expert modeling videos increased novice nurses' competence for delegation to unlicensed assistive personnel (UAP) more than voice over PowerPoint or reading assignments used as simulation preparation. This research adds to extant knowledge by incorporating a trained actor to portray the UAP, where previous research has operationalized delegation from a novice nurse to a peer portraying the role of a nurse extern (Kaplan & Ura, 2010) or Licensed Practical Nurse (Frontiero & Glynn, 2012). In this body of research, novice nurses delegated routine tasks, such as vital signs and blood glucose readings, without too much difficulty. One contributing factor that facilitated novice nurses' competence could have been the presence of the UAP within the simulation theatre. Therefore, future research could incorporate delegation to a UAP via an intercom or Vocera communication system that more closely mimics delegation practices in acute care settings.

Recommendations for future research are provided below in an attempt to provide guidance to help support or refute the use of simulation preparation to enhance novice

nurses' competence and increase their self-efficacy. Further discussion addresses many other questions that have emerged from this body of work.

Recommendations for Future Research

Longitudinal Measures of Competence

A major limitation of the randomized control trial in this body of research was that competence was only measured before and immediately after a five week intervention. While the trial and subsequent correlation study focused on change in competence between pre- and posttest, change scores could represent a surrogate for competence related to the short time frame between intervention and posttest assessment. Longitudinal measurement of competence will be necessary in future research to help sort out concerns around competence and how novice nurses' develop habits of practice, such that competence represents a journey and not a destination (Smith, 2012). The results of several studies indicate that novice nurses' competence for providing care to multiple patients improves with practice and educational interventions (Frontiero & Glynn, 2012; Ironside et al., 2009; Radhakrishnan, Roche, & Cunningham, 2007). But, more research is needed to address novice nurses' competence over time and the effect of interventions to increase continued competence.

Competence in Simulation vs. Actual Practice

Measurement of novice nurses' competence must also evolve to include competence in practice settings with actual patients. While simulation offers a psychologically safe environment for learning, assessment, and demonstration of behavior, simulation may not provide insight into how novice nurses apply knowledge in

actual practice (Miller, 1990). Seminal research in nursing called for competence assessment in the actual work environment (Benner, 1982). A limitation of this body of research is that competence was only measured in a simulation setting. As nursing is a practice discipline and novice nurses' competence in the care of actual patients is the desired outcome, measuring competence in actual practice should be addressed in future research. Without a doubt, novice nurses' competence develops over time, and educational research should follow the trajectory of competence development. In order to capture the full scope of novice nurses' competence and encourage their independent decision-making in an environment that is psychologically safe and safe for actual patients, measuring competence in simulation makes sense for pre-licensure novice nurses. After licensure, however, research regarding the trajectory of nurses' competence should incorporate assessment in less-controlled practice settings with actual patients.

Self-Rating vs. Objective Measures of Competence

All of the analyses included in this body of research measured novice nurses' competence objectively. In simulation, objective measures of competence require either live raters, like those incorporated into this body of research, or raters watching video recordings, but there are limitations to both methods. Reflecting on experiences in this body of research, multiple patient simulation researchers should consider using a combination of methods. That is, live raters may need to view a video recording for clarification or to resolve a conflict of interrater reliability. Unfortunately, video recording of multiple patient simulation is cumbersome related to the large number of cameras and computer feeds that would be required to capture patient monitors and

novice nurses moving around the simulation theatre. Regardless of the approach raters use for measuring competence objectively, it is important to recognize the time, cost and tradeoffs associated with these methods. As simulation research is in its infancy and there is theoretical support for measuring behavioral change in simulation (Miller, 1990), it is prudent to measure competence objectively in order to obtain a grasp of the scope of novice nurses' behaviors. However, future research could incorporate a combination of self-rating and objective measures of competence — where novice nurses rate their own competence using the same performance measure as objective raters. Recently, there has been critique of novice healthcare providers' self-rating of competence in the literature because of incongruence between self-rating and objective measures of competence (Eva et al., 2012; Kardong-Edgren, 2013), but research has not addressed how interventions might resolve the incongruence over time. Researchers should explore the relationships between self-rating and objective measures of competence before using self-rating as a surrogate for their objective counterparts. Contemporary methods and analytic approaches must be employed to account for interdependence of data, including a relationship between self-rating and objective measures of competence, in order to move simulation science forward.

Experimental Designs in Nursing Education Research

Conclusions from this body of research relate directly to design decisions and the choice of methodology. That is, using an experimental design provided us with a clearer picture of the effect of various simulation preparation methods on novice nurses' competence and self-efficacy. In this body of research, we observed that simulation

clearly relates to increased self-efficacy when researchers used an experimental design. Further, using a randomized control trial increased our certainty that differences in competence were related to our interventions. Differences in competence scores among our three groups revealed the true nature of the relationship between expert modeling and change in competence. Therefore, in order to advance the science of nursing education and further test the influence of simulation preparation methods on novice nurses' competence, future research should incorporate experimental designs. Moreover, researchers need to use rigorous methods, such as experimental designs, to effectively quantify trajectories of change in novice nurses and determinants that contribute to competence. Robust designs and contemporary analytic approaches must be employed to advance simulation science.

Recommendations for Nursing Education

In Support of Expert Modeling and Voice Over PowerPoint

Many nurse educators hold the view that senior undergraduate novice nurses should be able to discern salient points from reading assignments used as simulation preparation and that opportunities for clarification in debriefing are adequate to support novice nurses' competence. This assumption has been based primarily on teaching experience and is perhaps constrained by physical and monetary resources supporting simulation programs in academic and practice settings. Moreover, competence in nursing is also assumed to advance with immersion clinical experiences in the pre-licensure curriculum. Yet, results of this body of work support using expert modeling and voice over PowerPoint as simulation preparation as a way for nurse educators and novice

nurses to be proactive about enhancing competence. In particular, expert modeling videos and voice over PowerPoint improve novice nurses' competence for delegation and performing safety checks in complex simulations. Further, these active pedagogies enable novice nurses to demonstrate competence in simulation more than reading assignments used as simulation preparation. Previous simulation research has uncovered how quickly novice nurses' competence deteriorates over time in comparison to nursing knowledge (Oermann et al., 2010). Therefore, it is essential for novice nurses to achieve a level of initial competence in simulation and then work to maintain competence over time. Expert modeling videos and voice over PowerPoint may increase the likelihood that novice nurses' achieve initial competence in simulation. Thus, our recommendation is to use expert modeling and voice over PowerPoint as simulation preparation methods to enhance novice nurses' competence in simulation and in actual practice.

Promoting Novice Nurses' Competence for Providing Care to Multiple Patients

Novice nurses do not frequently have opportunities to manage the care of multiple patients in a pre-licensure curriculum. Yet, providing care for multiple patients is a key skill of modern nursing practice. Novice nurses have reported that low self-efficacy for providing care to multiple patients negatively affects their competence (Ebright et al., 2004). Therefore, nurse educators should facilitate multiple patient simulations to foster novice nurses' self-efficacy and competence. Well-designed multiple patient simulations can increase novice nurses' self-efficacy and facilitate their competence for providing care to multiple patients when several elements are considered. First, multiple patient simulation experiences should incorporate opportunities for priority setting, delegation,

safety checks, physical assessment, medication administration, and communication with licensed independent providers. Second, nurse educators should provide targeted simulation preparation to novice nurses prior to the simulation. Third, expert modeling videos and voice over PowerPoint foster novice nurses' competence more than reading assignments used as simulation preparation. Finally, scenarios should be mapped to the curriculum and to learning objectives for pre-licensure courses to ensure that novice nurses are challenged appropriately and supported in a complex multiple patient simulation. This information should be used to help nurse educators design multiple patient simulation experiences that increase novice nurses' self-efficacy and competence for providing care to multiple patients.

Conclusion

The purpose of this body of research was to increase our understanding of how simulation preparation enhances novice nurses' competence and increases self-efficacy. Results from preliminary descriptive, retrospective analyses provide evidence for reliability and validity of the NLN Student Satisfaction and Self-Confidence in Learning scale and reveal that simulation clearly increases self-efficacy. Further, results of prospective analyses from this body of research provide evidence that expert modeling videos and voice over PowerPoint used as simulation preparation increase novice nurses' competence and self-efficacy for providing care to multiple patients and that these simulation preparation methods are more effective to increase competence than reading assignments which represent "usual practice" for simulation preparation. Novice nurses who watched expert modeling videos demonstrated increased competence for delegation

and performing safety checks in simulation. Further, increased competence in simulation may transfer to increased competence in actual practice. In summary, the results of this body of work support using expert modeling videos and voice over PowerPoint as simulation preparation for novice nurses in complex multiple patient simulations.

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APPENDICES

Appendix A. National League for Nursing Student Satisfaction and Self-Confidence in Learning scale

Appendix B. National League for Nursing Simulation Design Scale

Appendix C. National League for Nursing Educational Practices Questionnaire

Appendix D. Creighton Simulation Evaluation Instrument™

Appendix E. Institutional Review Board Documentation

Appendix F. Consent Form for Human Subject Research

Appendix A

Student Satisfaction and Self-Confidence in Learning

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

Mark:

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

Satisfaction with Current Learning	SD	D	UN	A	SA
1. The teaching methods used in this simulation were helpful and effective.	1	2	3	4	5
2. The simulation provided me with a variety of learning materials and activities to promote my learning the medical surgical curriculum.	1	2	3	4	5
3. I enjoyed how my instructor taught the simulation.	1	2	3	4	5
4. The teaching materials used in this simulation were motivating and helped me to learn.	1	2	3	4	5
5. The way my instructor(s) taught the simulation was suitable to the way I learn.	1	2	3	4	5

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

Appendix B

Simulation Design Scale (Student Version)

In order to measure if the best simulation design elements were implemented in your simulation, please complete the survey below as you perceive it. There are no right or wrong answers, only your perceived amount of agreement or disagreement. Please use the following code to answer the questions.

<p>Use the following rating system when assessing the simulation design elements:</p> <p>1 - Strongly Disagree with the statement 2 - Disagree with the statement 3 - Undecided - you neither agree or disagree with the statement 4 - Agree with the statement 5 - Strongly Agree with the statement NA - Not Applicable; the statement does not pertain to the simulation activity performed.</p>							<p>Rate each item based upon how important that item is to you.</p> <p>1 - Not Important 2 - Somewhat Important 3 - Neutral 4 - Important 5 - Very Important</p>					
Objectives and Information	SD	D	UN	A	SA	NA	SD	D	UN	A	SA	
1. There was enough information provided at the beginning of the simulation to provide direction and encouragement.	1	2	3	4	5	NA	1	2	3	4	5	
2. I clearly understood the purpose and objectives of the simulation.	1	2	3	4	5	NA	1	2	3	4	5	
3. The simulation provided enough information in a clear matter for me to problem-solve the situation.	1	2	3	4	5	NA	1	2	3	4	5	
4. There was enough information provided to me during the simulation.	1	2	3	4	5	NA	1	2	3	4	5	
5. The cues were appropriate and geared to promote my understanding.	1	2	3	4	5	NA	1	2	3	4	5	

6. Support was offered in a timely manner.	1	2	3	4	5	NA	1	2	3	4	5
7. My need for help was recognized.	1	2	3	4	5	NA	1	2	3	4	5
8. I felt supported by the teacher's assistance during the simulation.	1	2	3	4	5	NA	1	2	3	4	5
9. I was supported in the learning process.	1	2	3	4	5	NA	1	2	3	4	5
Problem Solving	SD	D	UN	A	SA	NA	SD	D	UN	A	SA
10. Independent problem-solving was facilitated.	1	2	3	4	5	NA	1	2	3	4	5
11. I was encouraged to explore all possibilities of the simulation.	1	2	3	4	5	NA	1	2	3	4	5
12. The simulation was designed for my specific level of knowledge and skills.	1	2	3	4	5	NA	1	2	3	4	5
13. The simulation allowed me the opportunity to prioritize nursing assessments and care.	1	2	3	4	5	NA	1	2	3	4	5
14. The simulation provided me an opportunity to goal set for my patient.	1	2	3	4	5	NA	1	2	3	4	5

Feedback/Guided Reflection	SD	D	UN	A	SA	NA	SD	D	UN	A	SA
15. Feedback provided was constructive.	1	2	3	4	5	NA	1	2	3	4	5
16. Feedback was provided in a timely manner.	1	2	3	4	5	NA	1	2	3	4	5
17. The simulation allowed me to analyze my own behavior and actions.	1	2	3	4	5	NA	1	2	3	4	5
18. There was an opportunity after the simulation to obtain guidance/feedback from the teacher in order to build knowledge to another level.	1	2	3	4	5	NA	1	2	3	4	5
Fidelity (Realism)	SD	D	UN	A	SA	NA	SD	D	UN	A	SA
19. The scenario resembled a real-life situation.	1	2	3	4	5	NA	1	2	3	4	5
20. Real life factors, situations, and variables were built into the simulation scenario.	1	2	3	4	5	NA	1	2	3	4	5

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Appendix C

Educational Practices Questionnaire (Student Version)

In order to measure if the best practices are being used in your simulation, please complete the survey below as you perceive it. There are no right or wrong answers, only your perceived amount of agreement or disagreement. Please use the following code to answer the questions.

<p>Use the following rating system when assessing the educational practices:</p> <ul style="list-style-type: none"> 1 - Strongly Disagree with the statement 2 - Disagree with the statement 3 - Undecided - you neither agree or disagree with the statement 4 - Agree with the statement 5 - Strongly Agree with the statement NA - Not Applicable; the statement does not pertain to the simulation activity performed. 	<p>Rate each item based upon how important that item is to you.</p> <ul style="list-style-type: none"> 1 - Not Important 2 - Somewhat Important 3 - Neutral 4 - Important 5 - Very Important 										
Active learning	SD	D	UN	A	SA	NA	SD	D	UN	A	SA
1. I had the opportunity during the simulation activity to discuss the ideas and concepts taught in the course with the teacher and other students.	1	2	3	4	5	NA	1	2	3	4	5
2. I actively participated in the debriefing session after the simulation.	1	2	3	4	5	NA	1	2	3	4	5
3. I had the opportunity to put more thought into my comments during the debriefing session.	1	2	3	4	5	NA	1	2	3	4	5
4. There were enough opportunities in the simulation to find out if I clearly understand the material.	1	2	3	4	5	NA	1	2	3	4	5

5. I learned from the comments made by the teacher before, during, or after the simulation.	1	2	3	4	5	NA	1	2	3	4	5
6. I received cues during the simulation in a timely manner.	1	2	3	4	5	NA	1	2	3	4	5
7. I had the chance to discuss the simulation objectives with my teacher.	1	2	3	4	5	NA	1	2	3	4	5
8. I had the opportunity to discuss ideas and concepts taught in the simulation with my instructor.	1	2	3	4	5	NA	1	2	3	4	5
9. The instructor was able to respond to the individual needs of learners during the simulation.	1	2	3	4	5	NA	1	2	3	4	5
10. Using simulation activities made my learning time more productive.	1	2	3	4	5	NA	1	2	3	4	5
Collaboration	SD	D	UN	A	SA	NA	SD	D	UN	A	SA
11. I had the chance to work with my peers during the simulation.	1	2	3	4	5	NA	1	2	3	4	5
12. During the simulation, my peers and I had to work on the clinical situation together.	1	2	3	4	5	NA	1	2	3	4	5
Diverse Ways of Learning:	SD	D	UN	A	SA	NA	SD	D	UN	A	SA
13. The simulation offered a variety of ways in which to learn the material.	1	2	3	4	5	NA	1	2	3	4	5
14. This simulation offered a variety ways of assessing my learning.	1	2	3	4	5	NA	1	2	3	4	5

High Expectations	SD	D	UN	A	SA	NA	SD	D	UN	A	SA
15. The objectives for the simulation experience were clear and easy to understand.	1	2	3	4	5	NA	1	2	3	4	5
16. My instructor communicated the goals and expectations to accomplish during the simulation.	1	2	3	4	5	NA	1	2	3	4	5

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Appendix D - Creighton Simulation Evaluation Instrument (CSEI)™

ASSESSMENT		
Obtains Pertinent Subjective Data	0	1
Obtains Pertinent Objective Data	0	1
Performs Follow-Up Assessments as Needed	0	1
Assesses in a Systematic & Orderly Manner Using the Correct Technique	0	1
COMMUNICATION		
Communicates Effectively w/Providers (delegation, medical terms, SBAR, WRBO)	0	1
Communicates Effectively with Patient and S. O. (verbal, nonverbal, teaching)	0	1
Writes Documentation Clearly, Concisely, & Accurately	0	1
Responds to Abnormal Findings Appropriately	0	1
Promotes Realism/Professionalism	0	1
CRITICAL THINKING		
Interprets Vital Signs (T, P, R, BP, Pain)	0	1
Interprets Lab Results	0	1
Interprets Subjective/Objective Data (recognizes relevant from irrelevant data)	0	1
Formulates Measurable Priority Outcomes	0	1
Performs Outcome-Driven Interventions	0	1
Provides Specific Rationale for Interventions	0	1
Evaluates Interventions and Outcomes	0	1
Reflects on Simulation Experience	0	1

TECHNICAL SKILLS		
Uses Patient Identifiers	0	1
Utilizes Standard Precautions Including Hand Washing	0	1
Administers Medications Safely	0	1
Manages Equipment, Tubes, & Drains Therapeutically	0	1
Performs Procedures Correctly	0	1

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Appendix E

Institutional Review Board Documentation

Date: September 26, 2013

To: Christopher Lee, PhD, MSN

From: Kathryn Schuff, MD, MCR, Chair, Institutional Review Board
 Elizabeth Haney, MD, Vice-Chair, Institutional Review Board
 Lynn Marshall, ScD, Vice-Chair, Institutional Review Board
 Kara Manning Drolet, PhD, Associate Director, OHSU Research Integrity Office
 Andrea Johnson, JD, CIP, Regulatory Specialist, Institutional Review Board

IRB #: IRB00010038

Title: *Psychometric testing on the NLN SCLS using a sample of pre-licensure novice nurses*

DETERMINATION

Based upon the submitted information, the IRB has determined that the proposed activity:

Is not human subject research because the proposed activity:

- Does not meet the definition of human subject per 45 CFR 46.102(f)

This submission will be terminated from the eIRB system.

Date: October 14, 2013

To: Christopher Lee, PhD, BSN, MSN

From: Kathryn Schuff, MD, MCR, Chair, Institutional Review Board
 Elizabeth Haney, MD, Vice-Chair, Institutional Review Board
 Lynn Marshall, ScD, Vice-Chair, Institutional Review Board
 Kara Manning Drolet, PhD, Associate Director, OHSU Research Integrity Office
 Andrea Johnson, JD, CIP, Regulatory Specialist, Institutional Review Board

Subject: IRB00009850 , A Randomized Control Trial of Expert Modeling to Increase Novice Nurses' Competence and Self-Efficacy

Special Communication for Exempt Research

This protocol meets the requirements for Exemption from IRB review and approval in accordance with 45CFR46.101(b)[1], research conducted in established or commonly accepted educational settings, involving normal educational practices, such as research on regular and special education instructional strategies, or research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

You are required to submit any future revisions to this research activity for prospective IRB review via Modification Request. The IRB will determine whether or not the revision affects the study's Exempt status.

A HIPAA waiver of authorization is not needed because the protocol does not involve the collection, use, or disclosure of Protected Health Information (PHI).

Appendix F

Research Consent Summary

You are being asked to join a study. You do not have to join the study. Even if you decide to join now, you can change your mind later. One part of this study is optional. You may participate in the main study without participating in the optional part.

1. The purpose of this study is to learn more about the effects of various types of simulation preparation methods and how they affect novice nurses' self-confidence and simulation performance.
2. We want to learn
 - a. How novice nurses' competence and self-confidence increases as a result simulation preparation materials, and
 - b. If competence and self-confidence are related.
3. Everyone who joins the study will fill out two surveys. You will have a 1 out of 3 chance of being in an intervention group with expert modeling videos, voice over PowerPoint, or traditional pre-simulation readings.
4. If you join the study, you will complete a self-confidence survey 2 times over 8 weeks. The surveys will be delivered via the Sakai learning management system. You will complete them in the computer lab at the Simulation Center. You will have 2 simulation assessments at the Simulation Center. All intervention materials will be delivered via the Sakai learning management system.
5. We will look in your academic record to document your GPA and standardized ATI test scores.
6. Although we have made every effort to protect your identity, there is a small risk of breach of confidentiality.
7. If you agree, information collected during the study may be saved for future research. This information will be *de-identified*, which means that your name and any other personal identifying information will be removed from any information that is saved.

IRB#: 9850

Research Consent and Authorization Form

TITLE: A Randomized Control Trial of Expert Modeling to Increase Novice Nurses' Competence and Self-Efficacy

PRINCIPAL INVESTIGATOR: Christopher S. Lee, PhD, RN (503) 278-9073

CO-INVESTIGATORS: Ashley E. Franklin, MSN, RN (817) 929-7986
Stephanie Sideras, PhD, RN (541) 552-6249

RESEARCH ASSOCIATES: Christine Clifford, (541) 552-6227
Jeremy Hutson

FUNDED BY: Sigma Theta Tau International

PURPOSE:

You have been invited to be in this study because you are enrolled in N424 Integrative Practicum. The purpose of this study is to learn more about the effects of various types of simulation preparation methods.

This study requires 2 visits to the Simulation Center and will take 8 weeks to complete.

We are asking you to provide information for a data bank, also called a repository. This information will be *de-identified*, which means that your name and any other personal identifying information will be removed. Information stored indefinitely and may be used and disclosed in the future for research. Participation in the data repository is optional – you do not need to agree to let your information be used for future research to participate in this study.

For this study, we will enroll up to sixty participants at Oregon Health and Science University (OHSU).

PROCEDURES:

During the week of January 13 – 17, 2014, you will come for an individual simulation, which will last for 45 minutes. During the simulation, you will provide care to three mannequin patients. The simulation will focus on tasks associated with the beginning of shift in an acute care unit, including taking report, prioritizing patient care, physical assessments, delegation to an unlicensed personnel, and medication administration. After the simulation, you will complete a 5-minute self-confidence survey, answer some debriefing questions on Sakai, and be randomized to an intervention group.

After your first simulation, we will look in your academic record to document your GPA and standardized ATI test scores. This information will be used to describe the sample and will not affect your simulation, group assignment, or data analysis.

Next, you will have access to intervention materials on Sakai for five weeks between January 18 and February 23, 2014. You should view the intervention materials at least four times. This may take you eight hours to complete

During the week of February 24-28, 2014, you will return for an individual simulation, which will be very similar to the first simulation. This simulation will last for 45 minutes. After the simulation, you will complete a 5-minute self-confidence survey and answer some debriefing questions on Sakai.

	Visit 1 Day 1	Visit 2 January 13- 17, 2014	Visit 3 February 24- 28, 2014
Consent Discussion, Demographics survey	X		
Simulation		X	X
Self-Confidence Survey		X	X
Total time	30 minutes	2 hours	2 hours

During this study, you will be videotaped during simulation. We will use the videotapes only for purposes of this study, and we will not keep them for future research.

- All simulation assessments will be video recorded. Each simulation assessment will last approximately 45 minutes.

- The videos will not be kept for future research.

We are also asking you if you are willing to let qualified researchers use de-identified information from this study for future nursing education studies. The information will be labeled as described in the **CONFIDENTIALITY** section. This is optional. At the end of this form, there is a section where you can tell us whether or not you agree to let us do this.

If you have any questions regarding this study now or in the future, contact Christopher Lee at (503) 278-9073 or Ashley Franklin at (817) 929-7986.

The preliminary results of this study will be made available to you during an optional presentation at the OHSU School of Nursing Ashland campus in April 2014.

RISKS AND DISCOMFORTS:

The risks to human subjects include potential unpleasant feelings, such as embarrassment, emotional upset, frustration, and anxiety. Risks of participation include tiredness from answering survey questions or participating in simulation, anxiety about performance in simulation, and worry about loss of confidentiality/privacy. If survey questions or participation in simulation make you very upset, we will help you find a counselor. You may refuse to answer any of the questions that you do not wish to answer or delay completing the surveys until a later time.

Although we have made efforts to protect your identity, there is a small risk of loss of confidentiality.

BENEFITS:

You may or may not personally benefit from being in this study. However, by serving as a participant, you may help us learn how to benefit novice nurses in the future.

ALTERNATIVES:

You may choose not to be in this study.

CONFIDENTIALITY:

We will take steps to keep your personal information confidential, but we cannot guarantee total privacy. We take special precautions to prevent breaches of privacy: 1) Surveys you complete as part of his study are immediately de-identified and coded. This means that we immediately remove any identifying information and label them with a unique code that does not contain any person identifiers. De-identified surveys are kept in a double-password-protected and encrypted electronic file, and information from the surveys is entered into a password-protected, encrypted database containing no personal identifiers. 2) This signed consent form is kept in a locked file cabinet in a locked office in a secure building. 3) We

maintain one file that contains personal information and study codes (your name, email address, and phone number) so that we can follow up with you during your participation in this study. This file is double-password-protected and encrypted. Only the principal investigator has access to this file. 4) Information will only be placed in a data repository for use in possible future research if you indicate your agreement at the end of this form. Information saved for future research also contains no personal identifiers.

The investigators, study staff, and others at OHSU may use the information we collect and create about you in order to conduct and oversee this study, and, if you permit, to conduct future research.

We may release this information to others outside of OHSU who are involved in conducting or overseeing research, including:

- The sponsor of this study, Sigma Theta Tau International
- The Office for Human Research Protections, a federal agency that oversees research involving humans

We will not release information about you to others, unless required or permitted by law. We will not use your name or your identity for publication or publicity purposes, unless we have your special permission.

When we send information outside of OHSU, it may no longer be protected under federal or Oregon law. In this case, your information could be used and re-released without your permission.

Data from this study may be shared with other investigators for future studies. All identifying information about you will be removed from the samples before they are released to any other investigators.

We may continue to use and disclose your information as described above indefinitely.

COMMERCIAL DEVELOPMENT:

Samples and information including any photographs, videotapes, or audiotapes about you or obtained from you in this research may be used for commercial purposes, such as making a discovery that could be patented or licensed to a company. There are no plans to pay you if this happens. You will not have any property rights or ownership or financial interest in or arising from products or data that may result from your participation in this study. Further, you will have no responsibility or liability for any use that may be made of your samples or information.

COSTS:

There will be no cost to you to participate in this study.

We may request your social security number in order to process any payments for participation. To compensate for your time spent completing the simulation and surveys, you will receive a \$10 gift card and 6 hours of direct patient-care time for N424 after each visit. If you withdraw before completing the study, you will receive no further payment.

LIABILITY:

If you believe you have been injured or harmed while participating in this research and require immediate treatment, contact Christopher Lee, PhD, RN at (503) 278-9073.

You have not waived your legal rights by signing this form. If you are harmed by the study procedures, you will be treated. Oregon Health & Science University does not offer to pay for the cost of the treatment. Any claim you make against Oregon Health & Science University may be limited by the Oregon Tort Claims Act (ORS 30.260 through 30.300). If you have questions on this subject, please call the OHSU Research Integrity Office at (503) 494-7887.

PARTICIPATION:

If you have any questions regarding your rights as a research participant, you may contact the OHSU Research Integrity Office at (503) 494-7887.

You do not have to join this or any study. You do not have to allow the use and disclosure of your information in the study, but if you do not, you cannot be in the study. A part of this study (data repository for use in future research) is optional. You can still participate in the main part of the study even if you choose not to participate in this optional part.

If you do join the study and later change your mind, you have the right to quit at any time. This includes the right to withdraw your authorization to use and disclose your personal information. You can choose to withdraw from the optional part of this study (data repository) without withdrawing from the whole study. If you choose not to join any or all parts of this study, or if you withdraw early from any or all parts of the study, there will be no penalty or loss of benefits to which you are otherwise entitled. Talk to the investigator if you want to withdraw from the study or change which parts of the study you are participating in

Your request will be effective as of the date we receive it. However, information collected before your request is received may continue to be used and disclosed to the extent that we have already acted based on your authorization.

You may be removed from the study if the investigator or sponsor stops the study, you do not follow study instructions, if we cannot reach you by phone or email, or at the discretion of the Principal Investigator.

We will give you any new information during the course of this study that might change the way you feel about being in the study.

The participation of OHSU students in OHSU research is completely voluntary and you are free to choose not to serve as a research participant in this protocol for any reason. If you do elect to participate in this study, you may withdraw from the study at any time without affecting your relationship with OHSU, the investigator, the investigator's department, or your grade in any course. If you would like to report a concern with regard to participation of OHSU students or employees in OHSU research, please call the OHSU Integrity Hotline at 1-877-733-8313 (toll free and anonymous).

SIGNATURES:

OPTIONAL PORTION OF STUDY

The optional portion of this study (data repository) is described in detail throughout this consent form and listed here as a summary. Please read the option below and place your initials next to it if you choose to participate. You can still participate in the main part of the study even if you choose not to participate in this optional part.

_____ I give my consent for my survey information to be stored in a repository and used for future studies.

Your signature below indicates that you have read this entire form and that you agree to be in this study.

We will give you a copy of this signed form.

Subject Printed Name	Subject Signature	Date

Person Obtaining Consent Printed Name	Person Obtaining Consent Signature	Date