The Nature and Determinants of Presence Among Nursing Students Participating in High Fidelity Human Patient Simulation

Dissertation

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By

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Abstract

Human patient simulation is increasingly becoming an integral component of nursing education based on a variety of professional, educational, social, economic, political, and safety factors propelling its use. Yet the pedagogical science to support education with simulation remains underdeveloped. Scholarship on presence in virtual simulations has shown positive impact on learning outcomes. Yet presence as a variable of potential impact on learning outcomes with dynamic, scenario based, high fidelity human patient simulation (HF-HPS) has been little studied.

The aim of this grounded theory study was to examine the nature of presence in baccalaureate nursing students participating in HF-HPS and to develop a conceptual model that could explain the dimensions and determinants of presence as they may impact learning outcomes. A total of 36 simulation encounters were observed including 16 simulations from the sample of baccalaureate prelicensure nursing students, 12 simulations from the comparative sample of experienced registered nurses and 8 simulations from a comparative sample of second degree prelicensure nursing students. From these encounters, interviews were conducted with 60 nursing students from the primary sample and with comparative samples of 30 professional nurses, 32 second degree nursing students, 20 educators and 3 administrators for a total sample size of 145 participants.

The nature of presence was found to be a dynamic state of being with a centricity between the simulation and the natural environment where students perceived the stimuli from
one environment as salient over the other. The results revealed that presence was experienced in the domains of exocentricity, endocentricity, or bicentricity relative to the perceived salience of the simulation environment. Furthermore, the presence of students in scenario based HF-HPS was impacted by pedagogical factors, individual student factors, and group factors. Pedagogical factors found in this study included simulation design, stream of stimuli, and instructional process. Individual factors included personality characteristics, referential experiences, preconceptions, emotional responses, and entry competencies. Group dynamics and group structure were also found to be determinative of the nature of presence in HF-HPS.

The Nature and Determinants of Presence Model emerged from the study data to explain the articulation of the determinants of presence, the nature of presence, and learning outcomes. In this model, pedagogical, individual, and group factors are theorized to be determinative of the centricity of presence. Furthermore, presence centricity is theorized to impact learning outcomes. The Nature and Determinants of Presence Model in HF-HPS is presented to further guide research on presence as a factor that may impact learning outcomes in HF-HPS. This model is also offered to support continued development of a pedagogical science for education with clinical simulation.
Dedication

This work is dedicated to my dear husband and soul mate, Bradley.

My heart is filled with gratitude for his steadfast and unwavering support.

The waves forever flow,

The winds so gently blow,

The voyage sails on

To the places we dream to know.

This work is also dedicated to my son, Aaron, my daughter-in-law, Kelly,

my son, Brenton, and my daughter-in-law, Ann Marie.

I feel very blessed to have such a wonderful family.

I wish to express my appreciation for their patience, kindness, and loving support throughout this journey.
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I wish to express my sincere and deep appreciation to each of my committee members. Thank you to Rick Voithofer for serving as my advisor. I appreciate his expert guidance in the area of instructional technology and his gentle advocacy. Thank you to Bryan Warnick for opening my eyes to the beauty of philosophy. Thank you to Victoria Elfrink Cordi for her extraordinary expertise in the area of clinical simulation and her words of encouragement. Thank you to Patti Lather for her brilliant perspectives on qualitative inquiry. A special remembrance is also given here to Suzanne Damarin. She was the inspiration for this project at its inception.

I wish to also acknowledge the nursing faculty at Capital University, School of Natural Science, Nursing and Health. I appreciate their encouragement and support. I especially appreciate their dedication to excellence in nursing education.

Lastly, I wish to thank all the dedicated nursing students, faculty and professional nurses that gave of their time to participate in this study. Their willingness to share their experiences and their insights made a significant contribution to this research. It is hoped that their words conveyed in this work will help to advance the pedagogical science to support the application of clinical simulation in nursing education and through that may also support safety and quality in healthcare.
Vita

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Chapter 1: Introduction

...what remains timely is finding ways to work with simulation yet be accountable to nature. This is a complex undertaking: as we put ever-greater value on what we do and make in simulation, we are left with the task of revaluing the real. (Turkle, 2009, p. 45)

Background

In this Age of Technology, clinical simulation is increasingly becoming a desired and integral component of the education of health care professionals. Originating in the 1950s, clinical simulation in various forms has had a steady evolution particularly in nursing education. High fidelity human patient simulation (HF-HPS) is a type of clinical simulation involving the use of computerized mannequins combined with role-play enactment in a dynamic case study scenario involving a human health condition. The use of high-fidelity human patient simulation in nursing education is recently reaching more widespread recognition or adoption (Jeffries, 2007; Nehring & Lashley, 2010). Simulation is now acknowledged in nursing for its potential to support the development of competency in the domains of knowledge, skill acquisition/retention, cue recognition, clinical judgment, and for its potential value related to evaluation and competency testing (Bradley, 2006; Nehring
& Lashley, 2010; Rosen, 2008; Jeffries, 2007). This is in part due to rapidly advancing technical capabilities and realism offered in modern human patient simulator technology and the affordance that this technology provides to enact realistic dynamic human patient care situations.

Many factors continue to propel the adoption of HF-HPS as an instructional mode in health care practitioner and nursing education. At the forefront is the concern for patient safety and prevention of practitioner errors. The impetus for improving patient safety and quality of care is noted across professional practice publications and initiatives (Bradley, 2006; Gaba, 2007; Nehring & Lashley, 2010). The Institute of Medicine reports generated in recent years have asserted the need for safety and quality improvement in healthcare and the need for transformation of health care practitioner education to assure competency in the areas of patient-centered care, interdisciplinary teamwork, evidence-based practice, quality improvement, technology, and informatics (Institute of Medicine, 2000; Committee on Quality of Health Care in America, Institute of Medicine, 2001; Aspden, Corrigan, Wolcott, & Erickson, 2004; Greiner & Knebel, 2003). Accreditation bodies, government agencies, and private advocacy groups also have put forth national goals for improvement in patient safety. This is evident in the Joint Commission annual national patient safety goals for healthcare agencies (Joint Commission, 2009) and the publication of the Agency for Healthcare Research and Quality (2006, 2007) concerning quality indicators. The significant role of human patient simulation in improving safety and quality of health care is apparent in these reports (Bradley, 2006).
Similarly propelling the adoption of HF-HPS in nursing education is the increasing support from national nursing organizations and institutions (Cannon-Diebl, 2009; Nehring & Lashley, 2010). The National League of Nursing (NLN, 2003, 2005a, 2005b), the National Council of State Board’s of Nursing (NCSBN, 2005), the American Nurses Association (ANA, 2007), and the American Association of Colleges in Nursing (AACN, 2007, 2008) reports and position statements all address the advancement and evaluation of professional competency in nursing professional practice. Furthermore, use of simulation is referenced specifically in the AACN (2008), NCSBN (2005), and NLN (2005a) reports.

In 1996 the NCSBN proposed competency testing as a nursing licensure requirement. While this was voted down at that time, standardized competency testing is still being considered in nursing (Nehring & Lashley, 2010) and across other disciplines in professional health care practice (Bradley, 2006; Gaba, 2007; Nehring & Lashley, 2010). Simulation is currently recommended or being mandated as a part of training, licensure, and/or recertification in anesthesia and other areas of medicine (Gaba & Reamer, 2007). As was historically the case with simulation in aviation, standards, licensure, and certificating agencies likely will continue to be a major propelling force advancing simulation in health care and nursing in the interest of promoting competency and safety goals.

Often cited are other factors that continue to accelerate the use HF-HPS. Technological advances in HF-HPS offer increasing affordances for modeling a greater variety of clinical situations. The technology also provides an increasingly
authentic learning experience. The use of HF-HPS offers greater access to uncommon, low frequency, or inaccessible clinical situations to ensure learner skills and competencies within a limited time. The growing shortage of faculty and clinical sites for student placements may also be addressed in part by the use of simulation (Bradley, 2006; Kneebone, Nestle, Vincent, & Darzi, 2007; Nehring, Ellis, & Lashley, 2001). Furthermore, students may benefit from the nature of the learning experience provided with HF-HPS that affords self-paced learning, higher order thinking skills, immediate feedback, consistent curriculum, and potential development of student confidence and satisfaction (Ravert, 2002; Nehring et al., 2001; Issenberg, Gordon, Gordon, Safford, & Hart, 2001; Rauen, 2001; Cannon-Diebl, 2009).

The increased use of clinical simulation is actually nearing a point of widespread adoption and significant impact on health care across clinical practice disciplines and could transform learning in nursing education as well as in other health care disciplines (Bradley, 2006; Kiat, Mei, Nagammai, & Jonnie, 2007; Munusamy, 2007; Nehring & Lashley, 2004, 2010; Kneebone et al., 2005; Gaba, 2007; Gaba & Reamer, 2007; Jeffries, 2007). High fidelity human patient simulation has been praised for the potential to provide a realistic, authentic learning environment and for the potential of helping to prevent errors on human patients that can occur with novice learners. The technology permits a high level of authenticity in a learning environment that offers hands-on active learning activities and a socially collaborative experience that potentially induces a perception of immersion in reality. This has led to a presumption of authenticity among educators and professionals and a belief in the
potential that simulation technology could assist in learning transfer to the real world patient care context. This also has stimulated increased investment among higher educational institutions and health care organizations on the promise of the superiority of HF-HPS as an instructional mode and a potential means of reducing the shortage of clinical placements and high cost of health care practitioner education.

Yet, based on multiple propelling forces, the recent acceleration and expansion in the acceptance and adoption of HF-HPS in nursing education has preceded sufficient research on theory, pedagogy, learning, or health care outcomes to support, guide, and justify its use. Gaba (1992) offered a rationale as to why this trend has occurred despite the lack of foundation in theory, pedagogy, or outcome justification. He asserted “no industry in which human lives depend on the skilled performance of responsible operators has waited for unequivocal proof of the benefits of simulation before embracing it…” (Gaba, 1992, p. 491). However, the potential impact of simulation on nursing education and ultimately on health care outcomes encumbers the profession to seek to understand best practice pedagogy, as well as factors impacting the learner experience, learning outcomes, and learning transfer to the live clinical situation. Albeit growing, research in this area is currently in an underdeveloped stage justifying ongoing research (Weaver, 2011; Cant & Cooper, 2009; Rourke, Schmidt, & Garga, 2010).

Simulation situates learners in an artificially constructed social and spatial situation. This opens the need for greater understanding of the phenomenon of learner presence in HF-HPS in relation to how human presence in this technology mediated
learning context may impact perception, interaction, and experience, and ultimately may impact learning outcomes that may transfer to the real world patient care situation of which is represented and compared. Therefore, the aim of this study was to explore the nature and determinants of presence in nursing students learning by high fidelity human patient simulation.

The sense of presence has been defined as a conscious state of being that enables humans to perceive, to connect, and to interact in the world (Peach.org, 2006). Increasingly there is acknowledgment that the sense of presence is central to technology mediated experiences such as virtual reality simulation (Lee, 2004; Ijsselsteijn, 2003; Zhao, 2003; Heeter, 1992). Presence, a multidimensional state of being in a simulation, has been shown to have a positive impact on task performance (Witmer & Singer, 1994; Maida, Aldridge, & Novak, 1997; Welch, 1999; Stanney, 2000; Patel, Bailenson, Jung, Dianko, & Bajesy, 2006; Cavazza, Lugrin, & Buchner, 2007; Tichon, 2007). Technology and education studies of presence in participatory computerized simulations have also shown promise related to learning outcomes (Barab & Dede, 2007; Dede, 2005; Dede, Salzman, Loftin, & Ash, 2000). Yet, presence is little understood in the context of learning in HF-HPS, a mixed reality form. Presence in HF-HPS may potentially be a central and important factor in the learning experience and may impact learning outcomes and translational patient care outcomes.

Thus the ultimate purpose of this study was to explore the nature of presence among baccalaureate nursing students participating in dynamic HF-HPS scenarios and
to delineate a conceptual model that seeks to explain the dimensions and determinants of presence in HF-HPS. It was the goal of this research to support best practice pedagogy related to nursing education with HF-HPS in order to promote positive learning outcomes and ultimately learning transfer to the live human health care situation potentially leading also to improved safety and quality of patient care.

**Research Questions**

The following questions were used as a point of initial engagement and as a sensitizing framework to guide the research process. In keeping with an inductive thrust and emergent process of a grounded theory inquiry the research questions were developed broadly.

1. What is the nature of presence (dimensions and interactional process) experienced by baccalaureate nursing students participating in dynamic, scenario-based high fidelity human patient simulation?

2. What are the factors or determinants that bear on presence experienced by baccalaureate nursing students participating in high fidelity human patient simulation scenarios?

3. What is the articulation between presence and learning outcomes among nursing students participating in dynamic, scenario-based high fidelity human patient simulation?
Definition of Terms

A definition of terms is provided here. These definitions are stated broadly as intended for the point of initial engagement with a deliberative inductive inquiry. Some definitions are variable depending on the context of use. Therefore, definitions are further developed in Chapter 2. Full development of the concept of presence as it relates to the research question concerning the nature of presence in HF-HPS in this study is also presented in Chapter 4 – Results.

Presence: Presence is a subjective state of conscious being in interaction. Presence in human face-to-face, embodied interactions is the state where sensory awareness of the other triggers a psychological response that frames human conduct according to perceived identity and response to the other (Goffman, 1959, 1963). Mediated interactions are characterized by the variable use of technology to enable or extend human sense perception, interaction, and/or actions, and may also include a representation of the other or the situation such as in virtualities or simulations. In the technology mediated, virtual context, then, presence is defined simply as the subjective sense of “being there” (Minsky, 1980, p. 48).

Presence is thought to be impacted in the virtual context by the stimuli of the presence medium. The state of being present in this context has been characterized also by dimensions of immersion (sensory-perceptual envelopment) and involvement (focus/attention/action) (Witmer & Singer (1998). Presence in virtual situations or simulations is generally considered to have psychological, cognitive, social, and
actional domains. In virtual situations or simulations, the “virtual environments take advantage of the imaginative ability of people to ‘psychologically’ transport their ‘presence’ to” (Sadowski & Stanney, 2002, p. 791) the real situation of which it is represented by virtual means.

**Simulation:** Simulation is “the technique of imitating [representing] the behavior of some situation or process by means of a suitably analogous situation or apparatus, for the purpose of study or personnel training” (OED online, 2006). In particular, clinical simulation in nursing is defined as “activities that mimic the reality of a clinical environment and are designed to demonstrate procedures, decision making, and critical thinking through techniques such as role playing and the use of devices such as interactive videos [media] or mannequins” (Jeffries, 2005, p. 97). The aim of simulation is “to replicate some or nearly all of the essential aspects of a clinical situation so that the situation may be more readily understood and managed when it occurs for real in clinical practice” (Morton, 1995 p. 76). In this study, clinical simulation refers to an instructional method that provides an artificial, technologically mediated context representing a health care situation for the purpose of development of clinical reasoning and competency in clinical decision making and/or task implementation.

**High Fidelity Human Patient Simulation:** High fidelity human patient simulation (HF-HPS) is a form of clinical simulation that involves a technology comprised of a full-body mannequin, integrated monitor, and computer driven programming to represent realistic patient health conditions. Adjuvant to the
technology is the technique of scenario design and implementation of a “[dynamic] case study of a [psychosocial] or physical reality” (Gredler, 2003. P. 9) as well as an embodied role play interaction that induces the learner’s immersive presence in a realistic patient care situation and invokes response, action, and consequence.

**Relevance of Study in the Technological Age**

It could be stated that in this Age of Technology that most all human sensation, interaction, or experience is mediated through various forms of technology, be they machine, device, media, process, art, or virtuality. But simulation bears uniqueness in human sensory and perceptual process and experience. Simulation involves a representation of the unmediated, natural world by human designed technology, processes, and interactions that are constructed to promote a perception, or perhaps more clearly stated, a misperception of the real. In specific, clinical simulation is architected to represent particular aspects of the human health condition with a presumed level of authenticity being applied to train nurses and other health care professionals.

With the technological advancements afforded in HF-HPS, the use of clinical simulation in health education has moved beyond instrumental use for the teaching of operational skills and is beginning to be applied to learning for human contexts requiring interpersonal communication, perception of multisystem health status, cue recognition, diagnostic reasoning, prioritization, clinical judgment, and nursing intervention (Bearnson & Wiker, 2005; Kuiper, Heinrich, Matthias, Graham, &
Kotwall, 2008; Wong & Chung, 2002; Rauen, 2001; Lasater, 2007a; Radhakrishnan, Roche, & Cunningham, 2007; Sleeper & Thompson, 2008). The substitution of simulation for training on live human patients has also been entertained and explored as a potential option for meeting the challenges of health care professional education today (Bearnson & Wiker, 2005; Bradley, 2006; Nehring, 2008; Nehring & Lashley, 2004, 2010). The potential of these trends in nursing education coupled with the relatively little known outcomes of HF-HPS on learning and on human health command research attention around the relevant learning context of simulation in order to promote intended learning outcomes that transfer to the more complex, variable, and emergent human context to assure positive impact.

The Society for Simulation in Healthcare (SSIH) is an international organization whose mission is “to lead in facilitating excellence in multi-specialty health care education, practice and research through simulation modalities” (SSIH, 2011, p. 1). The organization recently endeavored to guide a more strategic direction on inquiry concerning clinical simulation and to stimulate a much needed, broadened scope of research topics to support education with simulation. Significant topics and priorities for research on simulation in health care were identified at the 2011 First Research Consensus Summit of SSIH. Among the eighteen topics discussed and the ten published research priorities were topics including learning and pedagogical theory, simulation psychology, and the research priorities of pedagogy science, learning, and translational patient outcomes (Dieckmann et al., 2011).
Aligned with the SSIH priorities, this research sought to explore the nature of presence as a dimension of the learning experience with potential impact on translational outcomes. An understanding of the nature, dimensions, and impact of learner presence in simulation may also support the development of pedagogical theory for HF-HPS. Ultimately the development of a conceptual model generated from this study could build on existing work to identify relevant factors in instructional design and pedagogical science for implementation and further research.

Simulation may change and redefine how learners think (Turkle, 2009) and come to know reality. As Kozma (1991) also once said, “the capabilities of a particular medium, in conjunction with the methods that take advantage of these capabilities, interact with and influence the ways learners represent and process information, and may result in more or different learning... (p. 179). These voices from both past and present challenge us to seek to understand HF-HPS as an instructional technique in the interest of promoting, in Dewey’s words, an educative learning experience (Dewey, 1986) that would increase the potential for a positive impact on learning and translational patient health outcomes.

Summary

Chapter 1 provided background concerning the increasing trend and significance of clinical simulation in health care education. The chapter also discussed the acceleration in the adoption of HF-HPS, in particular, that is based on a variety of professional, educational, economic, political, and safety factors. This trend
represents a movement of simulation in education from the teaching of purely operational skills, to learning contexts involving prioritization, reasoning, judgment, intervention, communication, and ultimately to a potential of the substitution of simulation for clinical training presently being provided in live patient care contexts.

Chapter 1 also introduced the problem of simulation based health care education that has occurred in such a way where adoption has preceded the development of a foundation of research on theory, pedagogy, and learning outcomes to support, guide, and justify its use. The encumbrance on the healthcare profession to provide this foundation together with the call from the SSIH provided justification at the outset of this study of the nature and determinants of presence in HF-HPS as one factor that may have significant bearing on learning outcomes. The initial point of engagement for this grounded theory study was set forth by the provision of the research questions and a definition of terms. Now in Chapter 2 is presented the literature review that traces the status of knowledge concerning the study concepts of clinical simulation and presence. The literature review provided a sensitizing framework for a grounded theory study that was directed at the development of a conceptual model that would identify the nature of presence in the context of HF-HPS and explain the determinants of presence as they might bear on learning outcomes.
Chapter 2: Review of Literature

*We make our technologies and our technologies shape us.* (Turkle, 2009, p. 9)

**Introduction**

Simulation techniques are increasingly being used for the education of health care professionals. Originating in the second half of the 20th century, clinical simulation has had a slow but steady evolution and is now reaching the point of widespread adoption in health care professional education. It is becoming widely recognized across disciplines that the broadening use of clinical simulation may revolutionize learning in medical and nursing education and may reach a point of significant impact on health care. (Bradley, 2006; Kiat et al., 2007; Munusamy, 2007; Nehring, 2008; Nehring & Lashley, 2004, 2010; Kneebone, et al., 2005; Gaba, 2004; Gaba & Reamer, 2007; Jeffries, 2007; Rosen, 2008). While the use of various forms of simulation has been an adjunct to teaching in formalized nursing education since the late 1950s, the use HF-HPS as a deliberate, integral component and pedagogy across curricula has largely occurred in the past decade and is now only recently reaching widespread recognition and adoption (Jeffries, 2007; Nehring & Lashley, 2010).
Presently the status of pedagogical science and research on factors that may impact learning and health outcomes related to HF-HPS as an instructional technique is underdeveloped. Presented in this chapter is a survey of the status of existing knowledge and research concerning high fidelity human patient simulation in academic baccalaureate nursing education and an examination of predominant pedagogical frameworks that currently guide the use of HF-HPS in nursing education. An overview of the conceptualizations of presence and a survey of presence measurement and impact is also undertaken here.

This integrative literature review serves to acknowledge the disciplinary perspectives and assumptions as a point of “initial departure” (Charmaz, 2006, p. 17) for this deliberative, inductive inquiry. To that end, this literature review is aimed at providing a sensitizing framework in support of a grounded theory study of immersive presence of nursing students learning by high fidelity human patient simulation.

Simulation

Evolution of clinical simulation. Prior to the 1990s, military applications accounted for 80% of all simulation work (Rosen, 2008; Drake, 1998). The military use of simulation coupled with innovations in plastics and computers as well as advancements in human resuscitation science and technology spurred the introduction of clinical simulation in the second half of the 20th century (Rosen, 2008; Bradley, 2006). The history of clinical simulation is then traceable back to the introduction of Mrs. Chase, the first plastic mechanical mannequin, in 1911 manufactured by the M. J.
Chase doll company (Hermann, 1981, 2008) and the first plastic skeleton in 1938 manufactured by Medical Plastics Laboratory. This was followed by the use of role play and standardized live human patient simulations by 1960.

Bradley (2006) classified the modern era of clinical simulation in health care education as originating in 1960 and progressing in three major movements demarcated by significant technological advancements: (1) task trainers, (2) moderate - high fidelity computer software based human patient simulators, and (3) educational integration of low – high fidelity simulation methodologies. Resusci-Anne, the task trainer developed in 1960 by the toy-maker, Asmund Laerdal in collaboration with anesthesiologists, is noted as the first significant development in modern simulation. This is recognized as revolutionizing mouth-to-mouth and cardiopulmonary resuscitation (CPR) and leading the evolution of increasingly technically sophisticated mannequins to support skills training in health care education (Bradley, 2006; Rosen, 2008). The second movement is marked by the development of computerized full-body simulators first developed as the SimOne by Abrahamson and Denson and further evolving into the comprehensive anesthesia simulation environments (CASE), the Gainseville anesthesia simulator (GAS), and the Harvey cardiology simulator (Bradley, 2006; Gaba & DeAnda, 1988). These simulators are considered the forerunners of today’s physiologically integrated Laerdal® and METI® mid – high fidelity human patient simulator mannequins (Bradley, 2006; Rosen, 2008; Nehring & Lashley, 2010).
Many other task and computerized trainers for advanced procedures and techniques have been developed over the course of these major movements having been used in medical, surgical, anesthesia, and nursing applications. The end of the 20th century brought significant advancement to simulation with the Visible Human Project (Rosen, 2008). Current and emerging computer-based systems include multimedia programs, computer-assisted instruction, virtual reality, haptic (tactile) systems, and multiuser virtual world applications (where users interact as avatars via Internet connection in simulation scenarios) (Bradley, 2006; Rosen, 2008; Nehring & Lashley, 2010). The development of more affordable, portable, and versatile mid-high fidelity human patient simulators is headed to be a revolutionary and transforming force in health care education (Jeffries, 2007). (For a more comprehensive historical chronology of simulation technology, see Rosen, 2008).

**Current trends concerning HF-HPS in nursing education.** The use of high fidelity, full body human patient simulation in medical and health care education has spanned only 20-30 years with only about a decade of use in nursing education (Bradley, 2006; Nehring & Lashley, 2010). While the exact prevalence of HF-HPS integration in nursing education programs is unknown, Nehring (2008) and Nehring & Lashley’s (2004) work provides some basis for understanding the trends and issues related to current adoption of HF-HPS.

Nehring and Lashley (2004) conducted an international survey of 66 nursing programs and 150 simulation centers, hospitals, armed services bases, and other higher
education institutions or businesses that had purchased a Medical Education Technologies, Inc. (METI) Human Patient Simulator. This study examined the use of human patient simulation (HPS) in nursing programs/courses, faculty training, student opinions, and use of HPS for competency evaluation. Of the 34 nursing schools and six simulation centers responding, HPS was reported as being most often used for teaching physical assessment (90.5%) and critical events (85.7%). About 57% reported that HF-HPS was used as a part of clinical time and 42.9% reported rarely or never using HF-HPS as a part of hospital based clinical time. Faculty were mixed on feelings regarding whether HF-HPS should be used for competency evaluation with 41.9% in agreement and 22.6% reporting that HF-HPS should not be used for competency evaluation. Ninety-three percent of schools reported that fewer than 25% of their faculty used HF-HPS. Only three (21.4%) of the schools reported conducting research concerning learning outcomes, student experience, or satisfaction with the use of HF-HPS. This study was the first to examine the current pattern of adoption of HF-HPS in nursing education.

The adoption of HF-HPS in nursing education is also impacted by the legal position of State Boards of Nursing. Nehring (2008) surveyed all boards of nursing in all states and including the District of Columbia and Puerto Rico. Forty-four (88.5%) reported on the current positions of State Boards of Nursing on simulation use in pre-licensure nursing education. At that time, five states and Puerto Rico had made recent changes in regulations to allow HF-HPS to be used as a substitute for clinical time.
Sixteen states had given approval for simulation to be used as a portion of clinical time and 17 states had substitution of HF-HPS for clinical time under consideration.

Most states do not specifically regulate clinical hours in nursing programs. Silence on stipulations of clinical hours leaves the door open for the use of simulation (Nehring, 2008). Florida stipulates a specific percentage of clinical time (≥50%) and that only 10% could be used with simulators (Nehring, 2008). Hawaii is the only other state that stipulates clinical hours with ≥40% required to be in clinical or laboratory teaching. The Nursing Education Study Committee of Ohio that was set forth to study the shortage of nurse faculty recommended that simulation be used to augment student nurses’ education but did not recommend that simulation devices be used as a substitute for clinical hours with live human beings due to the limitations of present technology and the lack of evidence on learning outcomes (Ohio Board of Nursing, 2008). Currently Ohio does not allow HF-HPS as a substitute for clinical hours in a nursing program (Ohio Board of Nursing, 2012).

Definitions / conceptualizations of simulation. A simulation is most simply, a representation of reality. Bradley (2006) referred to the following general dictionary definition of simulation as: “The technique of imitating the behavior of some situation or process by means of a suitably analogous situation or apparatus, especially for the purpose of study or personnel training” (OED online, 2006). In terms of the application of simulation specifically to education and training, simulation has also been defined as:
…[A] person, device, or set of conditions which attempts to present evaluation problems authentically. The student or trainee is required to respond to the problems as he or she would under natural circumstance. Frequently, the trainee receives performance feedback as if he or she were in the real situation.” (McGaghie, 1999, p. 9).

Simulation has also been defined in the context of health care applications. Clinical simulation has been defined as an attempt “to replicate some or nearly all of the essential aspects of a clinical situation so that the situation may be more readily understood and managed when it occurs for real in clinical practice” (Morton, 1995, p. 76). Clinical simulation may take many different forms and present with different technologies or learning environments. Gaba (2007) defined health care related simulation as “a technique, not a technology, to replace or amplify real experiences with guided experiences, often immersive in nature, that evoke or replicate substantial aspects of the real world in a fully interactive fashion” (p. 126). Similarly, Jeffries (2005) defined clinical simulation as “activities that mimic the reality of a clinical environment and are designed to demonstrate procedures, decision making and critical thinking through techniques such as role playing and the use of devices such as interactive videos or mannequins” (p. 97). Thus, the concept of simulation is a technique or method that is beyond any specific product or technology. In this study clinical simulation refers to an instructional method that provides an artificial, technologically mediated context representing a health care situation for the purpose
of the development of clinical reasoning and competency in clinical decision making and/or task implementation.

High fidelity human patient simulation (HF-HPS) is a form of clinical simulation that involves a technology comprised of a life-size human mannequin, integrated monitors, and computer driven programming, and also requires scenario design, administration, and an embodied role play enactment of a clinical scenario that induces the learner’s presence and clinical agency in the learning context. The mannequin is an integrated simulator programmed to provide real-time physiological and pharmacological parameters that are either pre-programmed (model driven) or may also be customized (instructor-driven) to simulate various health conditions. Commercial simulator mannequins contain various levels of programming and feature affordances in different models. (Nehring, Lashley, & Ellis, 2002; Maran & Glavin, 2003; Gaba, 2004; Bradley, 2006; Nehring & Lashley, 2010). These models are driven by programs of complex mathematical codes derived of scientific models of respiratory and cardiovascular physiology and pharmacological dynamics (Maran & Glavin, 2003). Today’s high fidelity human patient simulator technology, depending on the model, may present with potential responses of eye and pupil reactions, reflexes, color change, rash, perspiration, tears, muscle movements, heart and lung sounds, vital signs, and other physiological responses. The inputs and outputs afford a high level of fidelity to the actual clinical situation and offer hands-on active learning activities, as well as a social collaborative experience that potentially induces a sense of immersive presence and perception of reality.
Simulation is commonly referred to as ranging on a continuum from low to high fidelity classified based on the number of elements replicated or affordances provided in the technology/technique. Under this classification, low fidelity simulation would be considered a type of task trainer and also would include case study or role play (Jeffries, 2007). Low fidelity simulator technology ranges from simple to more complex and is designed as specific body parts or full-size mannequins. Examples of low fidelity simulators include limbs designed for injections or intravenous cannulation and static full-size mannequins (Maran & Glavin, 2003; Bradley, 2006; Jeffries, 2007; Nehring & Lashley, 2010). Moderate fidelity simulation permits auscultation of heart and breath sounds, palpation of some pulses, and intermediate task interventions. These models lack, for example, chest movements, eye blinking, or physiologic responses. Moderate/intermediate fidelity simulators include resuscitation style mannequins or intervention models such as Laerdal SimMan® or the Gaunard Noelle® obstetric simulator (Maran & Glavin, 2003, Nehring & Lashley, 2010). High fidelity human patient simulators are then characterized by the integration of real-time, dynamic physiologic modeling, signal/response monitoring, and complex intervention affordances providing a high level of interactivity and realism (Maran & Gavin, 2003; Bradley, 2006; Jeffries, 2007; Nehring & Lashley, 2010). Examples include the METI® and Laerdal® human patient simulators. A comprehensive list of simulator technology is presently available on the Pennsylvania State University SimLab website (http://www.pennstatehershey.org/web/Simlab/home/available).
HF-HPS is a form of mixed reality simulation. Mixed reality is considered to be the combination of reality and virtual reality. Milgram and Kishino (1994) defined mixed reality (MR) as “the merging of real and virtual worlds” (p. 1321) and also as a merger in some form along a continuum from a point of connecting completely real environments to a point of completely virtual environments. The virtual and the real are further distinguishable. A virtual environment is defined as a computer generated “mental model” that represents the actual environment and where a technology serves as a “presence medium” for an actual environment that may or may not really exist (Zhao, 2003). Presence mediums may take physical, electronic/digital, or verbal forms (Zhao, 2003). A virtual reality presence medium generates the mental model for the user by affording sensory stimulation and creates the virtual representation through content creation and delivery (Zhao, 2003). Mixed reality forms of simulation, then mix sensory stimuli from the virtual presence technology mediation and from stimuli in the local/natural context (Zhao, 2003; Davies, Mitchell, Dalhom & Nichols, 2003). The HF-HPS computer displays, mannequin, and moulage all serve as the virtual presence medium representing a real patient condition. The local/natural context in HF-HPS scenarios is the face-to-face interaction with an interdisciplinary team that may be comprised of real professional team members, actors, faculty facilitators, or students enacting roles.

**Scholarship on high fidelity human patient simulation.** Research on high fidelity human patient simulation in health care education is underdeveloped but
growing. The limited body of literature has been generated in the past 5-10 years and presently demonstrates gaps (Gaba, 2011) relative to pedagogical science and factors impacting learning and translational patient outcomes. A literature review was conducted using the following databases: CINAHL, Medline, Cochrane, Academic Search Complete, Education Research Complete, and Computers and Applied Science Complete. The literature review revealed that most of the existing research base is coming from anesthesia (medicine and nursing) and medical education. However, this review focuses on research reports on HF-HPS in academic pre-licensure, baccalaureate nursing education. Omitted from this review are the many and assorted opinion and issue papers concerning simulation and reports of simulation demonstration projects. Included are two review articles addressing a synthesis of the literature on HF-HPS in medicine. These articles are included to acknowledge the work in medicine and for the potential contribution to understanding the status of the science of HF-HPS applicable to nursing education. A brief survey of the anesthesia and medical literature is presented here first followed by the nursing literature to examine the current status of research on HF-HPS in academic nursing education.

Research on HF-HPS in medicine and anesthesia. Bradley (2006) identified only 109 medical articles that addressed learning through HPS; however, few of those reported were research defining outcomes or theory. Most reported here were generated from samples in medicine and anesthesia. Bradley (2006) focused on the history of simulation and did not synthesize the status of knowledge on HF-HPS and learning outcomes.
Issenberg, McGaghie, Petrusa, Gordon, & Scalese (2005) conducted a systematic review and qualitative data synthesis of research on HF-HPS and learning outcomes in medical education. There were 109 studies included that met the criteria of experimental or quasi experimental comparative research of HF-HPS used as an educational intervention out of a total of 670 articles on HF-HPS available in the literature at that time. The authors identified features and uses of HF-HPS that led to effective learning. These features included feedback, repetitive practice, curricular integration, level of difficulty, learning strategies, clinical variation, controlled environment, individualized learning, defined outcomes, and validity of the simulation (realism/fidelity and learner perception). The authors concluded that HF-HPS facilitates learning under the right conditions of the simulation. The authors also concluded that much research is needed on learning outcomes since 80% of the current studies were judged to be equivocal at best.

Issenberg et al. (2005) cited that heterogeneity of research designs, outcome measures, educational practices, and timeframes precluded meta-analysis. The authors also recommended the need for qualitative studies to better understand the atmosphere conducive to learning in simulation. The authors cited the importance of noting multidisciplinary scholarship on HF-HPS especially in the area of education science.

*Research on HF-HPS in nursing education.* The current status of the nursing literature is characterized by disparate research methods, heterogeneity of domains and dimensions studied, variability of educational practices and simulation design
characteristics, low theory integration (Rourke, et al., 2010), as well as mixed and inconclusive results. The research is categorized here and presented by the purpose of the inquiry followed by a synthesis based on factors and patterns that may impact learning outcomes that are beginning to emerge from the literature.

The published studies on HF-HPS in academic pre-licensure nursing education cluster into three purposive categories based on Polit and Beck’s (2008) classification: evaluation, outcome, and methodological. The literature review also reveals a pattern in the research of moving from a majority of descriptive and evaluation studies toward outcomes research. The body of scholarly work is replete with evaluation studies. The most recent pattern in publications is a trend toward outcomes research. Little work is evident in the methodological or theoretical domains. A review of research according to this categorization is presented here. Following a survey in each category, a synthesis based on emergent factors of simulation design characteristics, educational practices, and/or student factors is discussed.

*Evaluation research – student experience.* At this time, the literature is saturated with evaluation studies. A majority of these studies explored the student satisfaction or perceived value of HF-HPS and impact on perceived confidence and learning based on the students’ experience with a HF-HPS learning activity. These studies all used descriptive survey methods with instruments designed specifically for the study. Only two studies used established instruments in the method. The remaining studies evaluated various pedagogical approaches in the application of HF-HPS in nursing education.
In an early nursing study, Feingold, Calaluce, and Callen (2004) examined student perceptions of satisfaction including realism, skill transfer, and value of the HF-HPS learning experience in 65 senior nursing students. The study also examined faculty perceptions of support and training necessary to implement HF-HPS as an instructional technology. Student perceptions were measured using a 20 item Likert-style survey; faculty perceptions were measured using a 17 item Likert-style survey. Students participated in two HF-HPS scenarios. Results showed that students ranked the value of the experience highest (3.04) and the transferability of the experience the lowest (2.52). Technical skills were rated highest (3.53) compared to competence being ranked lowest (2.50). While a majority of students reported that the simulation was realistic (86.1%) and tested skills (83%) and decision-making (87.7%), less than half of the students agreed that their confidence (46.9%) or competence (46.9%) was increased. Faculty rated the experience of HF-HPS higher than students as being both realistic and effective (100%).

Similarly, in a study also using Feingold’s satisfaction survey instrument, Abdo & Ravert (2005) examined student satisfaction with the HF-HPS learning experience in the areas of realism, transferability, and value. Seventeen baccalaureate students participating in simulation as a part of their first medical-surgical nursing course were surveyed. All students responded with a perception that the elements learned in the HF-HPS would be transferable to the clinical. A majority (95%) perceived HF-HPS to be a valuable learning experience and 96% perceived the
simulation as realistic. This study is limited by small sample size and low reliability reported on instrument subscales (Abdo & Ravert, 2005).

Bearnson & Wiker (2005) in a descriptive survey evaluation explored students’ self-reported benefits and limitations of using HF-HPS as a substitute for one day of actual clinical practice. The simulation experience consisted of three different patient scenarios that mimicked the management of pain control in post surgical patients. A four item, four point Likert-type scale that also included three open-ended questions was used in this study to evaluate the self-perceived increase in knowledge, skill ability, and confidence in a small sample (two clinical groups of students - actual number is unreported) of junior level baccalaureate nursing students. Students rated the experience with HF-HPS positively for knowledge increase (3.13-3.31), skill ability (3.06), and confidence (3.00) in relation to satisfaction with learning medication administration in surgical patients using HF-HPS. The authors cited the small number of students and limitations of features of the mannequin as limitations in using HF-HPS as an instructional technology. Limitations of this study include small sample, lack of measurement of actual cognitive and psychomotor learning outcomes, and lack of reliability and validity tested and/or reported on survey instruments.

Bremmer, Aduddell, Bennett, and VanGeest (2006) examined the value of using HF-HPS as an educational methodology from the student perspective. The researchers conducted a two part learning activity where students assessed the simulator in two different clinical states. Bremmer et al. (2006) surveyed 41 undergraduate nursing students using a Likert rating scale concerning perceived
experience, confidence, and ability of the simulation experience to relieve stress in the live clinical experience. The instrument also included open ended questions concerning realism, confidence, benefits, and limitations. The majority of students (95%) rated the experience as either good or excellent. Sixty-eight percent rated that the experience should be required in the curriculum. Forty-two percent rated that the HF-HPS relieved stress on the first clinical day. The majority of students (61%) felt that the experience increased their confidence level.

In a similar evaluation study, Schoening, Sittner, and Todd (2006) examined student perceptions of their HF-HPS learning experience. In this study, 60 junior baccalaureate nursing students participated in an obstetrical HF-HPS scenario for a two week orientation to clinical care. The researchers used a ten item evaluation tool developed for this study to evaluate self-perceived confidence, critical thinking, satisfaction, learning transfer, and satisfaction with hands on learning and teamwork. A majority of students in this study reported positively on all evaluation parameters.

Related findings were more recently reported in Wotton, Davis, Button, and Kelton (2010). In this evaluation study, 300 third-year prelicensure nursing students evaluated HF-HPS as enjoyable, challenging, and congruent with course concepts. Yet, a majority of students (51.5%) also reported a sense of confusion during HF-HPS.

The Childs and Sepples (2006) study was a part of the National League for Nursing (NLN) collaboration with Laerdal, a three-year, multi-site study evaluating the use of simulation in nursing education. The study examined student perceptions of the educational practices of the simulation (active learning, collaboration, diverse
ways of learning, and high expectations), simulation design features
(objectives/information, support, problem solving, feedback, and fidelity), confidence,
usefulness, and feelings in 55 senior traditional and second-degree nursing students.
Perceptions of the educational practices were measured using the Educational Practice
Scale for Simulation (EPSS), a 15 item, five point scale; simulation design features
were measured using the Simulation Design Scale (SDS), a 20 item rating scale; and a
13 item survey designed for this study was used to explore confidence, usefulness, and
feelings. The students took part in four HF-HPS scenarios over two hours.

This study found the EPSS and SDS to be reliable and valid instruments
building upon the work previously done on these instruments in the NLN/Laerdal
study. Students rated feedback and objectives/information followed by complexity and
fidelity as most important on the SDS. Students rated the educational practices in the
following order of importance: feedback, collaboration, active learning, high
expectations, and diverse learning opportunities. The students reported high anxiety in
the mock code scenario but considered it to be a valuable learning experience. The
authors provided recommendations for pedagogical considerations including: the
importance of scenario planning and development, group size, faculty and staffing,
time for simulations, and debriefing. The authors did not report on student confidence
levels despite this factor being a stated objective of exploration of the study. This
study was strengthened by the use of reliable and valid instruments but was limited by
the use of self-report and use of an unestablished instrument for the measurement of
confidence, usefulness, and feelings.

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Kiat et al. (2007) also evaluated the self-reported learning experience with HF-HPS and effectiveness of their simulation training center. In 260 nursing students in a two year program in Singapore, the authors surveyed the students after 20 hours of simulation training over a six month period. The survey instrument developed for this study consisted of ten questions rated on a 4-point Likert scale concerning perceived benefits, actual experience with the simulation, and factors that may affect effectiveness of the simulation concerning the student’s learning experience and the effectiveness of the technical center.

The majority of students in this study perceived that simulation was enjoyable (93.8%), assistive in allowing students to think on their feet (95.4%), and assistive in helping students learn from mistakes (95.7%). Students reported increased self-perceived confidence (95.3%). Students also rated that simulation could improve communication (95%) and was a realistic experience (87.7%). However 11.9% of students disagreed by stating that simulation was not realistic (12.3%) and did not improve communication skills (11.9). This study took the variable of role into account and reported that 95.8% of non-role players perceived that simulation could encourage peer critique. Findings showed similar trends when these same questions were asked in rating the training provided by the Institute of Technology Training Center. Factors impacting the effectiveness of the simulation reported by the students included: quality of the scenario, realism of the simulator, availability of equipment, students’ preparedness, and facilitators interest and familiarity with equipment and software. This study concluded that students were highly satisfied with the learning experience.
and that simulation provided opportunities for skill development and problem solving. However, having not measured cognitive outcomes, the authors may have gone too far in concluding that this study demonstrated that role-players and observers of HF-HPS developed higher order cognitive skills. This study was also limited by lack of testing and/or reporting on the validity or reliability of the instrument developed in this study.

More recent evaluation studies continue to report positive student satisfaction with simulation and self-perceived, realism, increases in confidence levels, and projecting performance into the future. However, themes of anxiety and role confusion in the HF-HPS learning experience are also evident. Leighton and Scholl (2009) reported an increase in self perceived confidence in performing cardio-pulmonary resuscitation (CPR) and decreased fear of encountering a code in the real clinical situation among 30 undergraduate nursing students. Qualitative data from this mixed methods study also revealed themes of projecting performance into the future, role confusion, insecurity managing a code, perception of realism, lack of knowledge regarding role responsibilities, and personal feelings of fear, anxiety, and regret. Similarly, Garrett, MacPhee, and Jackson (2010) in a qualitative study reported increased confidence and role confusion among 30 senior level nursing student that were focus group participants. Likewise, in a phenomenological investigation, Cordeau (2010) also found themes along these lines concerning the lived experience of 19 nursing students learning in HF-HPS scenarios. Students described a perceived anxiety in five sub-themes including pre-simulation, beginning, intermittent, continuous, and debriefing anxiety. Students also described perceptions of realism,
performing-in-the-moment, and projecting into the future by preparing them more for the real world of nursing practice (Cordeau, 2010).

*Synthesis of evaluation research - student experience.* For these evaluation studies that explored the student perception of the learning experience related to HF-HPS, comparison or synthesis is hampered by the predominant use of incongruent measurement instruments and incongruent dimensions considered in the domain of satisfaction and value of HF-HPS as a learning activity. All but two studies use a self designed instrument with highly variable dimensions of student satisfaction and unestablished reliability and validity. Comparison is also hampered by the vast differences in the nature, amount, and timing of the HF-HPS scenario design features.

Yet, noting the limitations above, a qualitative data extraction from these HF-HPS evaluation studies reveals two emergent elements: the perception or importance of realism as a simulation design factor and an increase in perceived self confidence as a learning outcome. A majority of these studies demonstrated an increase in self-reported confidence in nursing students learning by HF-HPS (Bremmer et al., 2006; Schoening et al., 2006; Kiat et al., 2007; Bearnson & Wiker, 2005; Leighton, & Scholl, 2009; Garrett et al., 2010); but, increased confidence, while still shown in the Feingold et al., (2004) study, was perceived in under half of respondents. All studies demonstrated that HF-HPS was either perceived to be realistic or that realism was considered an important design feature (Abdo & Ravert, 2005; Bremmer, Aduddell, Bennett, & VanGeest, 2006; Schoening, Sittner, & Todd, 2006; Kiat et al., 2007;
Evaluation research – educational practices. The remaining evaluation studies reviewed are among early works to examine educational practices in relation to teaching with HF-HPS. These studies extend the first step taken by the NLN/Laerdal study (Jeffries & Rizzolo, 2006) to examine educational practices and design features that may impact the student experience and learning outcomes of HF-HPS. These studies concern diverse factors including group planning (Elfrink, Nininger, Rohrig, & Lee, 2009); intraprofessional group composition (Leonard, Shuhaiabar, & Chen, 2010); communication (Sleeper & Thompson, 2008); instructor characteristics (Parsh, 2010); diagnostic reasoning (Wong & Chung, 2002); and, the efficacy of using HF-HPS as an instructional method for teaching specific health contexts (Gantt & Webb-Corbett, 2010; Morrison & Catanzaro, 2010). The diversity of educational practices and the fact that these are among the early studies in this area make synthesis impracticable at this stage of inquiry related to HF-HPS in nursing education. Therefore, a survey of these studies is presented here to demonstrate the status of current knowledge concerning pedagogical approaches and evaluation of the efficacy of HF-HPS as an instructional method in various patient health contexts.

Elfrink, Nininger, Rohrig, & Lee (2009) in a qualitative evaluation study using survey and focus groups examined variables that most influence student attitudes about the simulation experience. Students reported high anxiety, feeling stressed,
distracted, and on the spot during simulation. This formative evaluation was aimed at lending insight into how to adapt HF-HPS educational practices to address high student anxiety. Students reported in this study that pre-planning and debriefing respectively were most productive to the simulation experience. Feelings of anxiety, stress, and distraction may suggest difficulty with student immersion and presence in the simulation that may impact learning outcomes. This research notably contributes to a beginning understanding of the importance of preplanning and debriefing as pedagogical considerations that may impact the learning experience and may contribute to learning outcomes with HF-HPS.

Another pedagogical consideration, group composition, was studied by Leonard, Shuhaibar, and Chen (2010). The authors examined student perception of the use of intraprofessional student groups composed of learners at different levels of the nursing program in HF-HPS scenarios. Forty-eight (48) students completed a qualitative satisfaction survey that the author’s designed for this study. Students reported on benefits of learning in an intraprofessional group composed of students from differing levels in the nursing program. Benefits included a sense of professional solidarity, role identification/differentiation, and adaptation to working in a team environment. However, again, in this study, students reported anxiety in the learning experience. This study was among the first to examine a peer coaching pedagogy.

Sleeper and Thompson (2008) examined the use of HF-HPS as an instructional method to enhance nursing students’ therapeutic communication skills. Faculty in this evaluation study designed a scenario and algorithm to simulate a psychiatric patient
encounter. The authors reported on the development of the HF-HPS scenario and algorithm for the communication interaction. Ten students participated in two HF-HPS scenarios and evaluated their experiences using a five point Likert-type survey instrument designed for this study where students rated their perception of whether the simulation augmented theory and clinical practice. Students also evaluated feedback, level of learning, and skill transfer related to the simulation experience. Ninety percent of students strongly agreed on all factors. The authors concluded based on the findings that the HF-HPS was an effective educational practice for providing students practice in therapeutic communication skills. The authors also cited the significant faculty preparation time and one-to-one student ratio required as limitations to this pedagogical approach. However the authors may have over extrapolated conclusions from these findings since communication was not addressed on the survey instrument. Sleeper and Thompson (2008) also did not report on the validity of the evaluation instrument. Therefore, items on the instrument may not or may only indirectly tap into the dimension of therapeutic communication. Students may have also responded to the survey items in relation to other aspects of the simulation experience.

A study by Wong and Chung (2002) evaluated HF-HPS as an instructional pedagogy for teaching diagnostic reasoning. Another aim of this study was to examine the difference in diagnostic reasoning in nursing students educated in either a university setting or in a stand alone nursing program. Ten students from each program participated in three case study scenarios using HF-HPS. The researchers examined study styles using the Biggs Study Process Questionnaire (SPQ); and, they
evaluated the accuracy of nursing diagnoses that students derived from the three scenarios. The SPQ has established validity reported in Biggs (1987) and Wong (1995). No significant differences were found between the two groups on study processes. University students demonstrated both horizontal and vertical reasoning patterns; whereas, the students from the nursing program showed only horizontal reasoning. This study was limited by small sample size. In essence this study used the HF-HPS as a standardized case study to evaluate differences in study processes and diagnostic reasoning between two different types of nursing programs. Thus this study contributes to the literature by demonstrating the use of HF-HPS as a competency evaluation method. However, this study offers little to the status of knowledge concerning simulation design or educational practices that may contribute to educational outcomes.

The Parsh (2010) study was among the first to evaluate teacher/facilitator characteristics as a factor relating to the learning experience with HF-HPS. This study reported on a small sample of eight nursing students’ perceptions of the characteristics of an effective instructor in a HF-HPS learning experience. Six-themes related to teacher effectiveness were identified through an interview evaluation study: personality characteristics, teaching ability, evaluation, nursing competence, interpersonal relationships, and realism. Patience, respect, facilitation style, positive and direct feedback, professional competence, and flexibility were perceived to be effective teacher attributes most assistive in the simulation learning activity.
Two studies reviewed here examined the use of HF-HPS as an instructional method for teaching specific patient health contexts. Gantt and Webb-Corbett (2010) described the integration of patient safety in teaching with HF-HPS. This study demonstrated the ability of this instructional mode to evaluate adherence to safety measures of hand washing and patient identification. In this study, 61% of students failed to perform correct hand washing or patient identification procedures; furthermore, 48% still failed to adhere to one or both safety precautions after increased lab orientation, lab practice, and adjustments to group size and faculty supervision. This evaluation was shown after an evaluative review of 110 student performance checklists.

Morrison and Catanzaro (2010) evaluated the use of a simulated emergency drill and the use of a HF-HPS for instruction on emergency preparedness. While the predominance of the simulation was a face-to-face role enactment of a simulated infectious disease outbreak scenario, a high fidelity simulator was used for the initial patient in the scenario. Seventy-nine undergraduate students enrolled in the public health course evaluated the learning activity in verbal debriefing sessions and in qualitative written reflections. Students also completed a quantitative likert-type survey designed by the authors for this study. Results of this study indicated that a majority of students (91.5%) agreed that the purpose of the exercise was clear and that the importance of performance in a public health emergency was stressed. Additionally 79.5% of students reported that briefing and debriefing aided their
understanding. However, themes from the qualitative analysis indicated that students
told overwhelmed and anxious in the learning experience.

*Outcomes research.* Research on learning outcomes with HF-HPS in academic
nursing education is increasing in the literature. Twenty-two works are surveyed here. Among those surveyed, 15 studies are comparative experimental or quasi-
experimental outcomes research. The other eight works are descriptive outcome studies. These studies focus on a variety of learning outcomes including: acquisition of knowledge, critical thinking/clinical reasoning/clinical judgment, self efficacy, confidence, clinical skill performance, and heterogeneity of secondary parameters. Again, the diversity of research methods, outcome measures, educational practices, and simulation design characteristics hamper a traditional research synthesis across outcomes regarding learning with HF-HPS. Yet, a data extraction of predominant outcome categories allows for an integrative synthesis across the outcomes of knowledge/cognitive skill, and a cluster of outcomes related to clinical agency including clinical reasoning, clinical judgment, retention, self efficacy, and confidence. A beginning comparison of outcomes associated with comparative pedagogical approaches follows.

*Knowledge – HF-HPS outcomes.* A growing number of studies have addressed the learning outcome of knowledge acquisition and/or knowledge retention. Six of the studies compared either learning by case study versus HF-HPS related to knowledge acquisition (Howard, Russ, Mitchell, & Nelson, 2010; Scherer, Bruce, &

Additionally, two descriptive studies examined the impact of HF-HPS on knowledge gain and/or retention (Elfrink, Kirkpatrick, Nininger, & Schubert, 2010; Hoffmann, O’Donnell, & Kim, 2007). Several of these studies addressed confidence and/or a heterogeneity of other secondary learning outcomes. Heterogeneity of the secondary learning outcome makes synthesis impractical on these variables.

The impact of HF-HPS compared to traditional pedagogical approaches shows some promise concerning knowledge acquisition in students learning by HF-HPS as opposed to learning by paper/pencil, interactive case study, or traditional classroom lecture or instruction methods. Four studies have examined pedagogical approaches. These studies are largely quasi-experimental with pre and post test or repeated measures designs.
Results revealed that senior pre-licensure students (n=49) divided between groups and tested with the Health Education Systems (HESI) standardized tests in the Howard et al.(2010) study showed that students in the HF-HPS group demonstrated significantly increased knowledge acquisition. The Alinier team (2004, 2006) also demonstrated a significant difference in knowledge acquisition in a comparison of standard (lecture based) instruction compared to HF-HPS among 67 students in the 2004 study and 99 nursing students in the 2006 study with the HF-HPS groups scoring higher. Brannan, White, and Bezanson (2008) also studied cognition in a quasi experimental study of 107 junior level baccalaureate nursing students comparing classroom lecture versus HF-HPS instructional methods. Students in the HF-HPS group scored significantly higher on a cognitive skills test concerning myocardial infarction designed for the study. Likewise, Ackerman (2009) examined knowledge acquisition and three month knowledge retention in an initial sample of 65 nursing students using a pre and post test comparative design of traditional versus HF-HPS pedagogy. Students receiving HF-HPS instruction demonstrated higher knowledge acquisition and retention on an extrapolation of questions from the American Heart Association (AHA) Basic Life Support (BLS) exam.

Knowledge acquisition and/or retention with HF-HPS were also examined in two descriptive studies (Elfrink et al., 2010; Hoffmann et al., 2007). Both of these studies examined knowledge level concerning medical/surgical and/or high acuity nursing care content following teaching/learning activities with HF-HPS. A pre and post test design was used in both studies where students also experienced regular
clinical practice either pre simulation (Hoffmann et al., 2007) or concurrent with simulation learning activities (Elfrink et al., 2010). Significant differences were reported in basic knowledge improvement on the basic knowledge assessment tool (BKAT-6) after simulation in 29 senior baccalaureate nursing students in the Hoffman et al. (2007) study. Similarly, a significant difference in knowledge acquisition and retention was demonstrated on NCLEX-RN style questions in the Elfrink et al. (2010) study in 84 upper division baccalaureate nursing students.

Yet in many other studies comparing a variety of pedagogical approaches with HF-HPS, no significant difference in knowledge or cognitive skill was demonstrated. There was no significant difference in knowledge acquisition in prelicensure students (n=403) between case study, static mannequin simulation, or HF-HPS in the Jeffries and Rizzolo (2006) study measured by NCLEX-RN style questions. King and Reising’s (2011) study also compared knowledge acquisition after use of static versus HF-HPS scenarios for advanced cardiac life support (ACLS) scenarios. Again, no significant difference in knowledge skill was shown in a sample of 49 BSN students on the AHA exam. Likewise, in the Beddingfield, Davis, Gilmore, & Jenkins (2011) quasi experimental study of 21 undergraduate nursing baccalaureate nursing students, there was no significant difference in knowledge measured on a critical care exam between the groups that received standard clinical with lecture versus HF-HPS with lecture. Sportsman, Schumacker, and Hamilton’s (2011) evaluation study was also consistent with these findings. No significant difference in grade point average (GPA)
or standardized exit exams was found in a large sample of 895 BSN and ADN students when HF-HPS was substituted for a percentage of standard patient clinical time.

A lack of significant difference in knowledge acquisition between pedagogical approaches (written case study or video) and HF-HPS pedagogy has also been demonstrated in studies of advanced practice nurses. Twenty-three nurse practitioner students were tested by a knowledge quiz modeled after Morgan, Cleave-Hogg, McLlroy, and Devitt. (2002) in the Scherer et al. (2007) study. No significant difference in knowledge was demonstrated between the groups receiving instruction with either case study or HF-HPS. Other studies of medical students or advanced practice nurses have similarly failed to demonstrate a significant difference in knowledge outcomes with HF-HPS compared to traditional lecture, video, or case study pedagogy (LeFlore, Anderson, Michael, Engle, & Anderson, 2007; Morgan, Cleave-Hogg, McLlroy, & Devitt, 2002; Knudsen & Sisley, 2000; Kaczorowski et al., 1998; Steadman, et al. 2006).

Thus, at this stage, the research is inconclusive regarding the impact of HF-HPS in comparison to other pedagogical approaches on knowledge acquisition. This state is likely due in part due to the variability in simulation contexts, lack of current knowledge concerning best practice pedagogy, gaps in understanding of factors that impact outcomes, and lack of methods to accurately assess outcomes. The inconsistency of findings related to knowledge acquisition in both descriptive and comparative studies across a variety of pedagogical approaches compared to HF-HPS suggests a need to better understand factors such as educational practices, simulation
design and implementation factors, or student characteristics and experiences that may impact knowledge as a learning outcome with HF-HPS. The findings do suggest that learning does occur with HF-HPS pedagogy. However, the comparison of knowledge acquisition or retention with HF-HPS with other pedagogical approaches is as yet unclear.

**Clinical agency – HF-HPS outcomes.** A cluster of studies have addressed a number of different or overlapping qualities of clinical agency including clinical judgment (Lasater, 2007a; Yang & Thompson, 2010), critical thinking/clinical reasoning (Kupier et al., 2008; Guhde, 2010; Brown & Chronister, 2009), self efficacy and confidence (Bambini, Washurn, & Perkins, 2009; Kameg, Howard, Clochesy, Mitchell, & Suresky, 2010; Blum, Borglund, & Parcells, 2010; Brown & Chronister, 2009), and clinical performance (Radhakrishnan et al., 2007; Swanson et al., 2010; King & Reising, 2011; Ackerman, 2009; Brydges, Carnahan, Rose, & Dubrowski, 2010) outcomes. These studies are very heterogeneous on the parameters of research design, dimension of clinical agency measured, simulation design, and educational practices. Clustering the data extraction on the category of clinical agency using clinical reasoning, clinical judgment, critical thinking, self efficacy, confidence, and clinical performance as indicators of clinical agency is assistive for a synthesis and analysis of learning outcomes related to HF-HPS. On the parameters of clinical agency the results of these studies demonstrate an inconsistent impact of HF-HPS on the indicators of clinical agency. A survey of the studies is presented here.
Lasater (2007a) in a qualitative study examined the impact of HF-HPS experience of nursing students (n=48) and the self-perceived development of clinical judgment. Data was collected by focus group facilitation using Morgan’s (1997) framework and a semi-structured interview guide stated to examine development of clinical judgment. Students reported themes that simulation was stressful, role playing was difficult, and some scenarios were more real than others. Students also reported that not enough time was spent on the scenarios; but, that simulation did require thinking for themselves. On the other hand, students reported that simulators had critical limitations related to communication and realistic human parameters. Students reported that physiological responses from the HPS were important feedback. Students also reported that debriefing was the most important phase for determining clinical judgment. The authors reported that a paradoxical effect of learning despite high anxiety in simulation occurred (Lasater, 2007a). Results of this study, such as the difficulty with role play and lack of authenticity, support the notion that features of the simulation design or student characteristics may impact the simulation learning experience and learning outcomes. A limitation of this study is the lack of integration of the dimensions of critical reasoning and clinical judgment in the interview guide; it is therefore questionable whether the study results fully tap into the outcome of clinical judgment development.

Yang and Thompson (2010) also studied clinical judgment in a comparative study of paper case scenarios versus physical HF-HPS case scenarios in 63 nursing students and 34 experienced nurses. Participants responded to 25 paper and physical
simulated scenarios generated from a dataset of real patient case records. No significant differences were evidenced between novices versus experienced nurses for clinical judgment outcomes. Again, no significant differences in judgment achievement were demonstrated for either group between paper case study versus physical HF-HPS case scenarios. This study also demonstrated a paradoxical effect in that clinical experience made no difference to nurses’ clinical judgment accuracy in either mode of simulation.

In a study of clinical reasoning, Kuiper, Heinrich, Matthias, Graham, and Bell-Kotwell (2008) compared clinical reasoning between authentic clinical experiences and HF-HPS experiences. In this descriptive study, 44 undergraduate nursing students participated in both authentic clinical activities and in HF-HPS scenarios. Clinical reasoning was measured by the Outcome-Present State Model (OPT) (Pesut & Hermann, 1999). Students completed an OPT written exercise as a measure of clinical reasoning for both authentic and simulation experiences. The highest OPT from the actual clinical experiences was compared to the OPT from the HF-HPS experience. In this study there were no significant differences in clinical reasoning between the two different learning experiences. The authors controlled for maturation effect; however, they concluded that the similarity of the actual clinical experiences to the HF-HPS may have impacted the results.

Two studies examined critical thinking along with other study variables. In both studies no significant differences were found on the outcome of critical thinking. Brown & Chronister (2009) studied critical thinking and self-confidence in 70 nursing
students exposed to traditional lecture and 70 students that received lecture and HF-HPS concerning training in an electrocardiogram nursing course. No significant differences were found between groups for critical thinking measured by Elsevier’s Evolve Electrocardiogram Custom Exam or for self-confidence measured using an instrument developed by the authors for the study. Similarly, Guhde (2010) examined self perceived critical thinking, assessment, and satisfaction in a comparative study of learning with two different levels, simple versus complex, simulation scenarios in a sample of 134 junior baccalaureate nursing students. The variables were measured using a survey instrument designed for the study by the authors based on the nursing education simulation framework by Jeffries (2005). No significant differences were found between the complexities of simulation scenarios on any of the variables.

Bambini, Washburn, and Perkins (2009) examined self-efficacy and confidence in 112 pre-licensure nursing students. A quasi-experimental pre and post test repeated measures design was used to examine the impact of a postpartum and newborn nursing simulation with low to high fidelity HPS on self-efficacy and confidence. Reliability and validity of the instruments designed for this study were established in the study. Results demonstrated a significant increase in self efficacy and confidence. Self-reported increases in perceived confidence, communication, and clinical judgment were emergent themes from qualitative data in this study. This study was limited by variations in the simulation experiences. The study also did not clearly define self-efficacy or describe the measurement instruments making it difficult to judge the validity of the results.
Kameg, Howard, Clochesy, Mitchell, and Suresky (2010) studied the impact of HF-HPS versus traditional lecture on self-efficacy of communication skills in a sample of 38 senior nursing students using a quasi-experimental time series design. Self efficacy of communication was measured using a single-item visual analogue scale designed for the study. General self efficacy was measured using an established self-efficacy scale. Students demonstrated a significant change in self efficacy following the simulation experience. This study was limited by small sample size and by the use of self efficacy as an indicator of communication skill.

Self confidence and clinical competence were examined by Blum, Borglund, and Parcells (2010) in a quasi experimental study comparing standard lab versus HF-HPS lab experiences among 53 baccalaureate students for health assessment and clinical skills. Self-confidence and clinical competence were measured using the established Lasater (2007) rubric. Items from this rubric were determined as measures of self-confidence and clinical competence. No significant difference in self-confidence or student competence between the standard laboratory or the HF-HPS lab groups was shown. Self-confidence and competency increased in both groups regardless of the learning approach.

Radhakrishnan, Roche, and Cunningham (2007) in a pilot study examined clinical performance parameters among 12 second-degree nursing students experiencing learning by HF-HPS. Variables of safety, basic assessment, focused assessment, prioritization, interventions, delegation, and communication were examined in a quasi-experimental design to evaluate the effects of simulation practice.
versus standard clinical teaching. Students in the simulation group demonstrated higher scores only for safety and basic assessment over the control group. There were no significant differences in performance on focused assessment, intervention, communication, and delegation. This study was limited by sample size, instrumentation, inter-rater reliability, and lack of control of clinical experiences that may have impacted performance.

Mixed performance outcomes were also found among three other comparative studies between HF-HPS and standard instruction techniques. The first two studies demonstrated higher skill performance in the HF-HPS groups. Ackermann (2009) in a quasi experimental comparative outcome study of CPR knowledge and skills found increased initial skill performance and increased retention skill performance in the HF-HPS group over the standard instruction group in a sample of 65 junior level baccalaureate nursing students. Similarly King and Reising (2011), while not finding a cognitive difference, did find a higher skill performance difference in the HF-HPS group over the static mannequin training for advanced cardiac life support (ACLS) skills in a sample of 49 baccalaureate nursing students. Yet, in the third study (Swanson, et al., 2010) performance findings were a little less clear. In this study, case based learning, simulation, and simulation with facilitated narrative were compared in a post-test, time series design. In all student groups, performance increased between the initial performance and the retention performance time; but, there was no significant difference between groups on skill performance.
A synthesis of these studies on the overarching category of clinical agency indicates inconsistency in the impact of HF-HPS demonstrated across studies. The heterogeneity of research designs, simulation designs, educational practices, dimensions of clinical agency, and methodological weaknesses hamper the determination of impact. Again, these findings may indicate that dimensions of clinical agency are increased with HF-HPS. However, whether there is a difference in these outcomes between HF-HPS and other instructional modalities is still unclear. Furthermore, with the heterogeneity of variables studied and lack of consistent approaches to simulation, the impact is difficult to analyze. The inconsistencies also suggest that other factors may be at play supporting the need for research on other dimensions that may impact learning outcomes.

Methodological research. There is a limited amount of methodological work available in the published academic nursing literature. In this review only three measurement instruments were revealed (Jeffries & Rizzolo, 2006; Todd, Manz, Hawkins, Parson, & Hercinger, 2008; Lasater, 2007b). The Jeffries and Rizzolo (2006) tools are aimed at evaluating the educational practices and simulation design. The Todd, Manz, Hawkins, Parsons, and Hercinger (2008) instruments and the Lasater (2007b) instruments are aimed at evaluating the student performance in relation to the educational objectives of the simulation. Other instruments have been applied to simulation such as instruments to measure critical thinking (Facione & Facione, 1998; Ravert, 2002) or instruments to evaluate simulation performance in
medicine (Morgan et al., 2002; Weller, 2004; Winston & Szarek, 2005). Jeffries and Rizzolo (2006) also identified a variety of instruments that may be applicable to simulation such as attitude scales and observation checklists, skill performance checklists, and reflective journal evaluation tools. However, the instruments surveyed here are methods identified and developed in nursing specifically for evaluation of the simulation experience and/or student competencies achieved through the simulation learning activity.

Jeffries and Rizzolo (2006) developed two instruments for evaluating the simulation experience in terms of simulation design and educational practices. The Simulation Design Scale (SDS) is a tool aimed at providing information for the improvement of the simulation design and implementation. The instrument is a 20 item rating scale that includes subscales measuring the five dimensions of simulation design: objectives, support, problem-solving complexity, fidelity, and reflection/debriefing. Items are scored on a five point rating scale. Scale dimensions are theorized as components of a simulation design integral to positive learning outcomes. The instrument has established content validity and an alpha coefficient of .94 establishing reliability (Jeffries & Rizzolo, 2006). The instrument was developed for the National NLN/Laerdal multisite simulation study.

The Educational Practices Simulation Scale (EPSS) was also developed for the NLN/Laerdal study (Jeffries & Rizzolo, 2006). The EPSS is a 16 item instrument that measures the extent of which best practice principles of education are incorporated in the simulation (Jeffries & Rizzolo, 2006). The tool measures four components of best
educational practices: active learning, diverse ways of learning, high expectations, and collaboration (Jeffries & Rizzolo, 2006). These best practice principles were based on quality teaching activities identified by Chickering and Gamson (1987). Items on the tool are scored on a five point rating scale. The EPSS has established reliability with a coefficient alpha of .92 and validity established by a nine nurse expert panel (Jeffries & Rizzolo, 2006).

Todd, Manz, Hawkins, Parsons, and Hercinger (2008) developed a quantitative evaluation instrument for simulations to evaluate student performance during clinical simulations. The instrument is based on the core nursing care competencies identified by the American Association of Colleges of Nursing (AACN, 2008): critical thinking, communication, assessment, and technical skills. The instrument identifies behavioral or performance indicators for each competency. Competency indicators are scored as present (1) or absent (0). Content validity was established by a panel of seven nurse experts. Interrater reliability was established for each subscale (84.4 - 89). This tool remains in early stages of refinement.

Development of clinical judgment is a primary aim of simulation in nursing. The Lasater (2007b) Clinical Judgment Rubric is a rubric/instrument for evaluating students’ clinical judgment during simulation or in clinical practice. This instrument is based on Tanner’s clinical judgment model (2006) that identified four dimensions of clinical judgment: noticing, interpreting, responding, and reflecting. This model describes the characteristics of clinical judgment expected of an experienced nurse. Lasater’s (2007b) rubric indentifies eleven indicators across the four dimensions of
clinical judgment. Indicators are scored on a four point scale from beginning to exemplary level of performance on each indicator. Reliability and validity of this instrument are in development. Construct validity is reported in Sideras (2008). To date this model has been evaluated in at least two published studies (Cato, Lasater, & Peeples, 2009; Dillard, Sideras, Ryan, Carlton, Lasater, & Siktberg, 2009).

**Models and theoretical frameworks grounding HF-HPS in nursing education.** The use of HF-HPS pedagogy in nursing education has traditionally been based on models or frameworks grounded in an eclectic application of learning theories. The framework grounding HF-HPS is also often based on the specific objectives of the learning activity. The model or framework drives the simulation design and educational practices of HF-HPS as an instructional strategy and ultimately has impact then on learning outcomes. Two frameworks/models are predominant in the application of HF-HPS across disciplines: the Crisis Resource Management Model (Gaba, Fish, & Howard, 1994) and the Nursing Education Simulation Framework (Jeffries, 2005, 2007).

*Crisis resource management model.* The Crisis Resource Management Model (CRM) originated out of the aviation industry in the 1970s in response to the study of factors contributing to plane crashes. A similar concern for patient safety was the impetus for the application of CRM to medicine and anesthesia. This model was first applied in anesthesia with the application of the first CASE simulator developed by anesthetist and engineer, David Gaba (Gaba & DeAnda, 1988). The philosophy
behind a CRM based simulation is to expose trainees to a realistic patient care crisis scenario where successful cognitive, behavioral, and teamwork skills facilitate the management of an unplanned, life-threatening event leading to a reduction of human errors and resource inadequacy/coordination resulting in improved patient outcomes.

The CRM model evidences behavioral, cognitive, and social dimensions. The CRM framework is built around a model of mobilizing the combination of technical and non-technical skills. The model emphasizes that requisite skills for managing medical crises depend on recognizing and understanding the situation, its evolution and its range of relevant solutions, cognition and decision-making, instrumental skill performance, and the ability to engage others in resource mobilization/utilization and teamwork. The philosophy for a simulation curriculum under a CRM model would include a catalogue of potential critical incidents with guidelines for prevention, recognition, and management, a theoretical framework for understanding human performance, case study scenarios for simulation, familiarization with the environment, realistic hands-on simulation, and structured debriefings on the technical and non-technical aspects of the event management (Howard, Gaba, Fish, Yang, & Sarquist, 1992).

Core concepts of the CRM model have been identified. These concepts are meant to complement pre-learned technical skills. The following concepts have been identified as those that are prevalent in CRM applications (Lighthall, 2008, p. 283).

- Maintain situational awareness
- Prevent fixation errors
- Know the environment and your teammates
- Distribute the workload
- Call for help early enough
- Practice effective leadership
- Communicate effectively
- Allocate attention wisely
- Anticipate and plan
- Use all sources of information and cross-check data streams
- Use cognitive aids to assure completeness

This model has been further developed and adapted since its origination. The basic tenets have been applied in nursing anesthesia to the ERR WATCH model: Environment, Resources, Reevaluation, Workload, Attention, Teamwork, Communication, and Help (Fletcher, 1998). The model has also been adapted to undergraduate nursing education as the Critical Incident Nursing Management Model (CINM) (Nehring et al., 2001; Nehring et al., 2002). This model is loosely defined as a competency-based framework emphasizing knowledge, technical skills, and critical thinking within the framework of nursing process (Nehring et al., 2002).

*The Nursing Education Simulation Framework.* The Nursing Education Simulation Framework (Jeffries, 2005, 2007) is a model developed to support the design, implementation, and outcome evaluation of simulations in nursing education. The model is also meant to specify theoretically relevant variables that may support effective teaching and the learner experience with simulation which may ultimately impact learning outcomes. This model also serves as a framework to guide needed research on human patient simulation and nursing education.

The Nursing Education Simulation Framework (Jeffries, 2007) is presented in Figure 1. The model was originally developed for and tested in the NLN/Laerdal
Simulation Study (Jeffries, 2005). The model is comprised of five conceptual components around a simulation educational intervention: teacher factors, student factors, educational practices, simulation design characteristics, and expected learning outcomes (Jeffries, 2005, 2007).

Figure 1. The Nursing Education Simulation Framework


The five conceptual components in the Jeffries model are loosely defined based on a melding of learning theory and a limited and developing body of research.
on simulation. [See Jeffries (2005, 2007) for a more detailed description of the conceptual component dimensions.] Under this model, successful learning outcomes are proposed to be impacted by the variables in the learning context and the degree to which best practices on these variables are designed and implemented in the simulation. This model is in the early stages of development particularly in the specification of student, teacher, and educational practice elements that may impact the learner experience and learning outcomes.

Learning theories and simulation. Evident in both of these models is an eclectic melding of learning theories applied to simulation in nursing and health care professional education. The learning traditions of behaviorism, cognitive, and situative constructivism are most salient in both the Crisis Resource Management Model and in the Nursing Education Simulation Framework. The theoretical melding is required based on the nature of health care as being a physical, social, interactional, and transactional human endeavor. This melding is also based on the nature of simulation as an instructional technique that is composed of cognitive, behavioral, collaborative, interactional, situative, and agentic dimensions. A full treatment of learning theory related to HF-HPS is outside the scope and intent of this work and would undermine an inductive thrust in the present study. However, a general discussion is given here to draw the connection between learning theory and the present models that guide present simulation pedagogy. Discussion of theories evident also serves to acknowledge the current disciplinary assumptions and perspectives.
Behaviorist learning theory had its origin with Thorndike, Hume, Locke, and Skinner and remains most characterized by the perspective of learning as the acquisitions of skills. Learning is viewed as a process of association, connection, and behavior where skills are acquired and transfer to similar situations may occur (Greeno, Collins, & Resnick, 1996). Learning environments from a behaviorist perspective are organized around behavioral objectives, concept and task decomposition, instructivism/empiricism, performance support, response feedback, diagnostics, and pre/post testing (Wilson & Myers, 2000; Greeno et al., 1996).

Evident in both simulation models is an emphasis on instrumental skill acquisition based on behaviorist theoretical underpinnings. Skill acquisition is a fundamental concern in training for readiness to act in crisis or critical life-threatening situations. Here health care practitioners need skill in responding in prescribed, sequential, and predictable ways. Here practitioners need to respond with immediacy, automaticity, and expert technique. Applied to simulation then, skillful behaviors learned in the simulated environment would be transferrable to the live crisis situation upon which human life may depend.

Yet, human health care situations always occur in a situated context where individuals respond in unique and complex ways. Such multiple and contextual responses require cue recognition, clinical reasoning and judgment, flexible response patterns, collaboration, and teamwork. Human health needs are also embedded in social and spiritual domains. Health care practitioners need also to be trained to
operate in such a context. Learning for such individualized, holistic, and collaborative professional nursing role requirements demands a more situative learning approach.

Situative learning perspectives view knowledge as distributed among humans and their environment. Learning is then viewed as a process of activity in interaction with other individuals in the context of an environment of mediating objects, artifacts, tools, and communities of practice (Lave & Wenger, 1991; Greeno et al., 1996; Wilson & Myers, 2000). Learning environments under situated learning theory would encompass learning in context, active participation, communities of practice, knowledge in action, mediating artifacts, interactionism, and identity construction of the self in a role (Wilson & Myers, 2000).

Under this framework are a variety of traditions, including cognitive constructivism or situated cognitions. Building on these perspectives also adds the notion that knowing is both an attribute of the practice group but also the act of individual cognition of those individuals participating in the community of which they are members (Greeno et al., 1996). Within this framework is the acknowledged contribution of meaning making as both an individual and a collective socially constructed activity (Wilson & Myers, 2000). Working then within both cognitive and situative constructivist frameworks is the basis for training health care practitioners in simulation for individual cue recognition, clinical reasoning, and judgment while at the same time training individuals for collaboration, communication/interaction, teamwork, leadership, and workload mobilization and distribution.
This theoretical integration is most strongly seen in the Crisis Resource Management Model (Gaba & DeAnda, 1988). Based on the early stage of development of the Nursing Education Simulation Framework (Jeffries, 2005) the theoretical integration while present is less fully articulated. Greeno, Collins, and Resnick (1998) argued that the strengths and values of behaviorist and cognitive perspectives may be combined within the practices of a situative framework. The models and frameworks of simulation presented here exemplify the potential benefit of this type of integrated theoretical framework in the educational practice of simulation.

Learning theory has largely been in service of rationale for using HF-HPS based on its inherent nature as a cognitive yet collaborative and situated learning activity. Currently there is criticism in the literature concerning the lack of theory based research that would support an understanding of best practice pedagogy and positive learning outcomes (Rourke et al., 2010; Dieckmann, et al., 2011). While learning theory is relevant as to the purpose of using simulation, there is need for development of pedagogical science as well as application and development of theories related to technology and education. Much of theory seen in present works represents theory importation and overlay rather than theory development, integration, or testing. This status of inadequate theory development for HF-HPS served also as a justification for this grounded theory study to support advancement of the pedagogical science to guide the use of HF-HPS in nursing education.
While research on HF-HPS continues to build, this literature review demonstrates a predominance of descriptive and evaluation studies. The literature displays underdevelopment of theoretical frameworks or a pedagogical science. There remains a very limited body of methodologic work or outcome studies; and, outcome studies are currently inconclusive. Continuing on, the following strand of literature review surveys the status of knowledge on the construct of presence related to HF-HPS.

**Presence and Human Patient Simulation**

The sense of presence is a conscious state of being that enables humans to perceive, to connect, and to interact in the real world (Peach.org, 2006). Increasingly there is realization that the sense of presence is central to technology mediated experiences extending from as low tech as reading a book to as high tech as virtual reality simulation (Lee, 2004; Ijsselsteijn, 2003; Zhao, 2003; Heeter, 1992). HF-HPS as a representation of the real situates humans in an artificially constructed social, physical, spatial, and virtual situation. This opens the need for understanding the phenomenon of presence in simulation related to how simulation may impact human presence concerning perception, interaction, experience, and ultimately on learning outcomes and transference to the real world of which is represented and compared.

The construct of presence is fluid, multi-dimensional, complex, and embedded in the situational context. Throughout the past 20-30 years, much academic focus
across disciplines including neuroscience, psychology, philosophy, engineering, computer science, cognitive science, telecommunications, tele-operations, aviation, space, military science, and telemedicine, has been directed at understanding the nature and ramifications of presence for its importance in guiding technological development and for its impact on human activity in the world. Therefore, the aim here is to examine the status of scholarship on presence in simulation with an emphasis on definitions and dimensions of presence that have been identified and measured across disciplines. Assumptions around the nature and representation of reality in simulation and how this may bear on presence are also examined. This analysis serves to acknowledge prior understandings of presence as applied in both live interaction and computer centered virtual reality for sensitization to presence in HF-HPS. To date the literature is nearly silent on presence as a factor in the learning experience with HF-HPS. Gaining understanding of the nature of presence and of how presence may be operational in HF-HPS, a mixed reality form of simulation, may be an important pedagogical concern in training nurses for the health care of human beings in the real world context.

**Presence conceptualizations.** The progressive development of technology innovation has enabled an ever broadening and engaging human experience necessitating the evolution of the conceptualization of presence related to technology mediated human interactions. Despite considerable analysis and multidisciplinary discourse in the literature, a standard, universal definition of presence has not been reached. Yet, consensus has been achieved around general dimensions of presence
and the need for flexibility and fluidity in situating a definition of presence in relation to the context. The development and evolution of presence as a theoretical construct applied to technology mediated contexts is examined here. The multidimensionality and complexity of presence as situated in the context of human interaction and experience mediated by technology and simulation in particular is evidenced in this analysis.

**Evolution of the concept of presence.** The perceived presence in unmediated or natural social interactions is traceable to the social psychologist, Erving Goffman (1959, 1963), and his concept of co-presence (Biocca & Nowak, 1999, 2001; Biocca, Harms, & Burgoon, 2003). Co-presence refers to face-to-face and embodied interaction where sensory awareness of the other triggers a psychological response that frames human conduct according to perceived identity and response to the other. For Goffman (1959, 1963), sensory perception is the means of communicating and experiencing social co-presence in natural, embodied interactions. Goffman’s (1959, 1963) conceptualization also included the impact of the environment on interaction where physical distance, obstructions, temperature, and the sensory medium may influence the salience and accessibility of presence and of perceiving the other (Biocca et al., 2003). Goffman’s (1959, 1963) work may be interpreted as a conceptualization of presence not as either being present or not, but as experienced on a continuum. His theoretical analysis is a basis for understanding the nature of presence in relation to action and the dimensions of place, awareness, attention, focus, and environmental elements impacting presence in human interaction (Biocca et al.,
2003). Furthermore, Goffman’s (1959, 1963) interpretation of co-presence in unmediated communication has been applicable to conceptualizations of presence in mediated interactions.

Mediated interactions are characterized by the variable use of technology to enable or extend human sense perception, interaction, and/or actions. Steuer (1992) similarly made this distinction between natural perception and telepresence. Early work on presence in relation to technologically mediated interaction advanced first in the field of telepresence and communications stimulated by telecommunications and media technologies. This conceptualization is noted by the interrelated perspectives of presence as being either physical versus social in nature (Heeter, 1992; Biocca, 1997; Biocca et al., 2003). Physical presence alludes to interaction where persons are located in different spatial environments and are enabled to sense the presence of the other as being in the same location, space, or environment. Most often termed telepresence, this refers to the sense of “being there” in the remote location facilitated by a technologically mediated space that creates the illusion of place (Biocca et al., 2003). This view is seen in the work of Mason (1994), McLeod, Baron, Marti, and Yoon (1997), and Sallnas, Rassmus-Grohn, and Sjostrom (2000). The concept of social presence is traceable back to Mead’s (1934) symbolic interactionist perspective of the other being a symbolic construction created through interaction and is also traceable to Short, Williams, and Christie’s (1976) application of this psychological framing to inquiry on teleconferencing and other media systems. Social presence is,
then, the sense of “being together with another” when interacting in different spaces, mediated through technology.

Marvin Minsky (1980), however, is generally credited with first introducing the concept of presence related to technology mediated interaction. His conceptualization was derived from his work at Massachusetts Institute of Technology (MIT) in artificial intelligence, telepresence, and teleoperations (Bouvier, 2008; Salvini, 2006; Insko, 2003; Ijsselsteijn, 2003). He used the term, “telepresence,” to describe the experience of using remote-controlled robotic devices. His vision was to stimulate the development of remote control technology that would enable the elimination of hazardous tasks and could support the creation of new medical techniques, remote working, and space exploration (Ijsselsteijn, 2003). In his words:

The biggest challenge to developing telepresence is achieving that sense of ‘being there.’ Can telepresence be a true substitute for the real thing? Will we be able to couple our artificial devices naturally and be comfortable to work together with the sensory mechanisms of human organisms?

(Minsky, 1980, p. 48).

His concept of presence as the subjective sense of “being there” (Minsky, 1980, p. 48) in reference to a remote technology and mediated environment is still one of the most widely quoted and basic concepts of presence understood today.

Scholarship on telepresence and the conceptualization of presence as “being there” is derived in the context (Heeter, 2003) associated with the aim and affordances of the telecommunications and teleoperations technologies. Here the sense of
Telepresence is the perception of “being” there, (Zhao, 2003) transported to a remote space of interaction (Sheridan, 1992). The distinction here is based on the affordance of technology to provide sensory extension in a situation where one may reach and interact in a remote environment without “being,” there. Zhao (2003) defined remote environment as a physical space containing people, objects, and events that are beyond the reach of natural human senses and direct perceptual contact in the immediate surroundings. He also defined sensory extension as the expanded range of human senses afforded through technological mediation (Zhao, 2003). Sheridan (1992) defined telepresence as the “human control of vehicles, manipulators, and other systems using video, audio, kinesthetic, and tactile feedback from the remote site” (p. 120). Telepresence, then, is associated with a sense of transportation and interaction in a remote but real field of action.

Technologies affording sensory extension such as a telescope, radio, television, or teleoperator systems (remote-controlled robotics) aim to facilitate non-interactive, one-way contact, communication, or action (telepresence); whereas, technologies such as telephone or email facilitate interactive, two-way contact or communication (telecopresence) (Zhao, 2003; Ijsselsteijn, 2003). The distinction here is that the technology affords genuine contact with a natural or real person, object, or environment; but, the technology does not provide the content of the interaction (Zhao, 2003).

Scholarship related to telepresence or telecopresence addresses a focus on technical system operation, form, features, and performance. Social psychological
questions such as how well persons connect through the interface or satisfaction with interactive connections have also been of interest. A survey of work on telecopresence (Biocca et al., 2003) reveals a concentration in communications theory, communications technology, and educational communications (Ciolek, 1982; Biocca & Nowak, 1999; Biocca & Harms, 2002; Mason, 1994; McLeod, Baron, Marti, & Yoon, 1997; Tammelin, 1998; Sallnas, Rassmus-Grohn, & Sjostrom, 2000; Gunawardena & Zittle, 1997; Cudihy & Walters, 2000; McLellan, 1996). A concentration concerning psychological involvement is also evident including foci on perceived access to another’s intelligence (Biocca, 1997), salience of the other (Short, Williams, & Christi, 1976; Gunawardena, 1995; Rice, 1993), mutual understanding (Savicki & Kelley, 2000), and intimaecy and immediacy (Mehrabian, 1967; Argyle & Dean, 1965; Argyle, 1969). A more comprehensive survey of scholarship on telepresence is found in Stanney and Salvendy (1999) and Lee (2004).

The term, presence, is attributed to Sheridan’s (1992) use of the term, virtual presence, as distinguishable from the term, telepresence. Presence, the term in current use, refers most commonly now to the psychological process associated with users of virtual technologies. This more general conceptualization of presence while not differentiated by specific technology (Lee, 2004) has developed out of the change in context embedding human-computer, human-human, human-object/environment interaction that virtual technology mediums create. Where telepresence mediated by telecommunications or teleoperations technology yields a perception of “being’ there” [emphasis on being]; presence mediated by virtual technology refers to the
experience of “being ‘there’” [emphasis on there] in a perceived environment (Zhao, 2003). The sense of presence is distinguishable as being contextualized by technology that not only mediates on communication or interaction, but also provides content through sensory stimulation and artificial representations of real persons, objects, or environments (Zhao, 2003).

A fundamental difference then is between the human perception of interaction with what is natural or genuine versus the perception of interaction with a representation of the real presented by the virtual technology medium (Zhao, 2003). Zhao (2003) defined a virtual environment as “a perceptual model generated by a presence medium that is different from the physical environment that the model represents” (p. 141) (ie. video games, and virtual reality tools such as head-mounted displays or computer simulation and training environments). Presence in the virtual context is then impacted by the level of perceptual fidelity of the virtual representation and the sensory stimuli of the presence medium since users are aware that they are engaged in an artificial situation having no real-life consequence (Zhao, 2003). Furthermore, the sense of presence stimulated by virtual mediums is predicated not only upon perceptual realism but also upon the user’s willingness to suspend disbelief (Holland, 2003; Reeves & Nass, 1996; Zhao, 2003; Lee, 2004; Dede, 2005; Dede et al., 2000).

Advancement and diversification in virtual technology have also led to synthetic and mixed reality forms of technology mediation on human interaction (Zhao, 2003; Milgram & Kishino, 1994). Zhao (2003) delineated these forms as
merging the sense of “‘being’ there” [emphasis on being] and “being ‘there’” [emphasis on there] simultaneously in a single environment simulating both a local or remote and a virtual presence in the user experience. Examples of synthetic and/or mixed reality forms include tele-immersive systems, virtual interfaces with avatar human representations, (Zhao, 2003; Ijsselsteijn, 2003) computer simulations, and high fidelity human patient simulation.

Synthetic, virtual, and mixed reality environments vary greatly in affordances for connection, communication, action, and interaction. Through differing synthetic virtual, and mixed forms, users may interact with various combinations of a local, natural, or virtual self, object, or environment and with either a remote real or virtual representation of people, objects, or environments in real-time or asynchronous engagement (Zhao, 2003). Mixed realities may also co-mingle the synthetic world with the real world (Wagner et al., 2009; Benyon, 2006; Milgram & Kishino, 1994) on what Milgram and Kishino (1994) represented as spanning a continuum from completely real environments to completely virtual environments where augmented realities (AR) are considered real world with added virtual features and augmented virtualities (AV) are considered virtual world with added real elements (See figure 2). HF-HPS in this model would be, then, an augmented virtuality (AV) on the virtuality continuum.
The mixing of sensory stimuli from the presence medium enabling local, remote, and virtual modes of interaction in relation to natural and real context invokes a more complex psychological state of presence. This variability in the affordances of technology to mediate on human experience and the complexity of the psychological process of presence has contributed to difficulty in reaching a universally applicable conceptualization of the presence construct. There are diverse and broadening perspectives on the construct of presence in relation to psychosocial and behavioral emphases reflecting the variability in the context and the affordances of mediating technology. Yet, a convergence on basic definitions and determinants of presence across disciplines and technology application is also evident.

**Presence definitions.** Definitions of presence have developed from rather unidimensional to more multidimensional conceptualizations. The initial work on
defining presence places emphasis on a user’s sense of physical place in a virtual environment. Yet the need to understand presence relative to more diverse technology mediated contexts and the need to understand dimensions of and influences on presence have stimulated diverse reconceptualizations of the presence construct. The review of definitions found in the literature may be clustered into groups that place particular emphasis on components of or responses to the user’s presence as a state of being. The predominant definitions of presence in the literature may be grouped according to the categories of: Environmental/Physical, Engagement/Immersion, Actional/Agentic, Perceptual/Illusional, Cognitive/Perceptual, Sociocultural, and Multidimensional. These categorizations and definitions are summarized in Table 1. Note that the classification of presence definitions is not meant to represent a bounded ideograph nor is it to be considered exclusive or exhaustive. In fact, most definitions could be placed in more than one category since elements of previous definitions are often evident in subsequent conceptualizations; and, earlier definitions often foreshadow elements in later definitions. However, the categorization may illuminate the particular shifts and trends in prevailing conceptualizations concerning the nature of presence as a human state of being and response to the virtual technological mediation on experience. Highlights and explanations on the survey and classification of the conceptualizations of presence presented in Table 1 follow thereafter.
<table>
<thead>
<tr>
<th>Classification</th>
<th>Source</th>
<th>Conceptualization of Presence</th>
</tr>
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<tbody>
<tr>
<td>Environmental/</td>
<td>(Minsky, 1980, p. 48; Sheridan, 1992; Held &amp; Durlach, 1992)</td>
<td>A subjective sense of “being there.”</td>
</tr>
<tr>
<td>Physical</td>
<td>(Steuer, 1992, p. 76)</td>
<td>“[T]he extent to which one feels present in a mediated environment,</td>
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<td></td>
<td>rather than in the immediate physical environment.”</td>
</tr>
<tr>
<td></td>
<td>(Witmer &amp; Singer 1998, p. 225)</td>
<td>“[T]he subjective experience of being in one place or environment,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>even when one is physically situated in another.”</td>
</tr>
<tr>
<td></td>
<td>(Draper, Kaber, &amp; Usher, 1998)</td>
<td>A mental state where a user feels physically present within the</td>
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<td></td>
<td></td>
<td>computer mediated environment.</td>
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Table 1. Classifications and Conceptualizations of Presence
### Table 1 continued

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<tr>
<th>Classification</th>
<th>Source</th>
<th>Conceptualization of Presence</th>
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<tbody>
<tr>
<td>Engagement / Immersion</td>
<td>(Maida et al., 1997)</td>
<td>A “sense of engagement” in interaction with a virtual environment.</td>
</tr>
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<td></td>
<td>(Slater &amp; Wilbur 1997, p. 603-616; Slater, 1999, p. 560-561)</td>
<td>“The sense of being there in the environment depicted by the VE:...the extent to which the VE becomes the dominant one, i.e., that participants will tend to respond to events in the VE rather than in the real world;” and “the extent to which participants, after the VE experience, remember it as having visited a place rather than just having seen images generated by a computer.”</td>
</tr>
<tr>
<td></td>
<td>(Kalawsky, 2000, p. 1)</td>
<td>The “perceptual sense of being” in a virtual environment.</td>
</tr>
<tr>
<td></td>
<td>(Witmer &amp; Singer, 1998, p. 225)</td>
<td>“Presence refers to experiencing the computer-generated environment rather than the actual physical locale.”</td>
</tr>
<tr>
<td>Actional/Agentic</td>
<td>(Zahorik &amp; Jenison, 1998, p. 87).</td>
<td>“[P]resence is tantamount to successfully supported action in the environment.”</td>
</tr>
<tr>
<td></td>
<td>(Turner, 2007, p. 127)</td>
<td>“[T]he experience of being somewhere arising from the interplay of technological, psychological and bodily factors....”</td>
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<tr>
<td></td>
<td></td>
<td>“The sense of presence is a product of an intentionality-affordance dynamic.”</td>
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<tr>
<th>Classification</th>
<th>Source</th>
<th>Conceptualization of Presence</th>
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</thead>
<tbody>
<tr>
<td>**Actional/Agentic</td>
<td>(Herrera, Jordán, &amp; Vera, 2005, p. 201, 206)</td>
<td>“Presence is more about ‘experiencing agency’ than ‘pretending to be there’ or than constructing and reconstructing mental models in real time… [E]xercising agency is a necessary companion in the journey that enables us to take a subjective stance and thus have a sense of presence…”</td>
</tr>
<tr>
<td><strong>continued</strong></td>
<td>(Presencia Project, 2003)</td>
<td>“Acting/behaving in the virtual world as in the real world.”</td>
</tr>
<tr>
<td>**Perceptual /</td>
<td>(Lombard &amp; Ditton, 1997; Lombard &amp; Ditton, 2000, p. 77)</td>
<td>“[T]he perceptual illusion of nonmediation.”</td>
</tr>
<tr>
<td><strong>Illusionary</strong></td>
<td>(International Society for Presence Research, 2000, <a href="http://www.ispr.info/">http://www.ispr.info/</a>)</td>
<td>“Presence…is a psychological state or subjective perception in which even though part or all of an individual’s current experience is generated by and/or filtered through human-made technology, part or all of the individual’s perception fails to accurately acknowledge the role of the technology in the experience… her/his perceptions overlook that knowledge and objects, events, entities, and environments are perceived as if the technology was not involved in the experience.”</td>
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<tr>
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<th>Source</th>
<th>Conceptualization of Presence</th>
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<tbody>
<tr>
<td><strong>Perceptual/ Illusionary continued</strong></td>
<td>(Biocca, 1997)</td>
<td>The illusion of “being there” whether or not.</td>
</tr>
<tr>
<td></td>
<td>(Biocca et al., 2003, p. 459)</td>
<td>“[T]here” exists in physical space...” “the phenomenal sense of “being there’ including automatic responses to spatial cues and the mental models of mediated spaces that create the illusion of place.”</td>
</tr>
<tr>
<td></td>
<td>(Lee, 2004, p. 32)</td>
<td>“[A] psychological state in which the virtuality of experience is unnoticed.”</td>
</tr>
<tr>
<td></td>
<td>(Slater &amp; Usoh, &amp; Steed, 1994)</td>
<td>“the (suspension of dis-) belief of being located in a world other than the physical one.”</td>
</tr>
<tr>
<td></td>
<td>(Lodge, 1999)</td>
<td>“The users’ experiences of media is that an illusion is generated whereby a user senses that she/he is located somewhere other than his/her physical environment.”</td>
</tr>
<tr>
<td><strong>Cognitive / Perceptual</strong></td>
<td>(Lee, 2004)</td>
<td>Direct perception of currently present stimuli rather than on conceptual processing; special cognitive mechanisms such as automatic and modular processing.</td>
</tr>
<tr>
<td></td>
<td>(Barfield &amp; Hendrix 1995, p. 3-16)</td>
<td>“[A] cognitive state’ consistent with a sense of ‘being there’ in an environment, a state that results from attending to and evaluating incoming sensory information.”</td>
</tr>
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<thead>
<tr>
<th>Classification</th>
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<tbody>
<tr>
<td><strong>Sociocultural</strong></td>
<td>(Mantovani &amp; Riva, 1999, p. 538-548; 2000; Riva &amp; Mantovani, 2000, 32-38)</td>
<td>“Presence is a cultural-pragmatic construction. Presence is a product of the action performed in the environment, where the perceptual stimuli sent to the participants and the technical qualities of the interface are but two ingredients.” Presence is situated in a sociocultural field/frame of action (real or simulated) where individuals can perceive themselves, objects and others immersed in a sociocultural web connecting to interactions in the environment.</td>
</tr>
<tr>
<td><strong>Multidimensional</strong></td>
<td>(Sanchez-Vives &amp; Slater, 2005, p. 332-339)</td>
<td>“[Presence is the] extent to which participants respond to virtual sensory data as if it were real, where response ranges from unconscious physiological responses, through behavioral responses, through to feelings, emotions and thoughts.”</td>
</tr>
<tr>
<td></td>
<td>(Lee, 2004, p. 37)</td>
<td>“A psychological state in which virtual (para-authentic or artificial) objects are experienced as actual objects in either sensory or nonsensory ways.”</td>
</tr>
</tbody>
</table>
Environmental / physical presence definitions. The original definitions of presence in relation to interactions with virtual environments are stated simply as the sense of “being there” (Minsky, 1980; Sheridan, 1992; Held & Durlach, 1992). This conceptualization refers to a sense of the self being physically transported to a virtual world. Evident in these and later environmental/physical definitions is the subjective feeling of being in an environment other than the primary or immediate physical environment. As such, Steuer (1992) defined presence as “the extent to which one feels present in a mediated environment, rather than in the immediate physical environment” (p. 76). Similarly, Witmer & Singer’s (1998) often quoted definition of presence is, “the subjective experience of being in one place or environment, even when one is physically situated in another” (p. 225).

Engagement / immersion presence definitions. Definitions of presence also cluster around the recognition of virtual environments to stimulate and overtake the senses into the virtual environment to the exclusion of sensory-perception of the primary, natural environment. These conceptualizations of presence recognize immersion as a component of presence where immersion refers to the degree that the virtual environment can stimulate and involve the senses. These definitions also recognize engagement as the degree that users become engrossed and involved in the virtual environment. Maida’s definition captures this sensibility directly where presence is viewed as a “sense of engagement” in interaction with a virtual environment (Maida et al., 1997)). This emphasis on engagement is also seen in Slater
& Wilbur (1997, p. 603-616) and Slater (1999, p. 560-561) in their definition of presence as:

The sense of being there in the environment depicted by the VE [virtual environment]:...the extent to which the VE becomes the dominant one, i.e., that participants will tend to respond to events in the VE rather than in the real world;” [and] “the extent to which participants, after the VE experience, remember it as having visited a place rather than just having seen images generated by a computer.

**Actional / agentic presence definitions.** Zahorik and Jenison’s (1998) simplistic and parsimonious definition of presence is distinguished by its emphasis on action in the virtual environment. Action relates to task performance or the behavioral dimension related to presence. Here, “presence is tantamount to successfully supported action in the environment” (Zahorik and Jenison, 1998, p. 87). Successfully supported action is further clarified in their definition as being when the environmental reactions to the user’s actions are legitimate and meet the user’s expectations (Zahorik & Jenison, 1998; Lee, 2004). While the Zahorik and Jenison’s (1998) definition stands out as uniquely emphasizing the relationship between perception and action, more recent reconceptualizations of presence also move this orientation further toward an understanding of the role of agency or intentionality associated with the sense of presence (Turner, 2007; Herrera et al., 2005).

**Perceptual / illusional presence definitions.** A predominant perspective on the nature of presence has been the prevailing belief that presence involves a “suspension
of disbelief” as the basis for sensory override and a user’s giving to engagement in virtual environments. This mental orientation has also been termed the acceptance of presence as being a state of epistemic failure (Fiordi, 2005). The conceptualization of Lombard and Ditton (1997; 2000) involving the sense of “being there” is also a frequently cited definition of presence. Here presence is defined as, “the perceptual illusion of nonmediation (Lombard & Ditton, 1997; 2000, p. 77) where “perceptual” refers to real time responses of, continuous sensory, cognitive and affective processing to objects and entities in the environment (Lombard & Ditton, 2000, p. 77); and, the illusion of ‘non mediation’ refers to a phenomenon where a person “fails to perceive or acknowledge the existence of a medium in his or her communication environment and responds as he or she would if the medium were not there” (p. 77). This concept of presence as being based an illogical perceptual illusion, non-mediation, or epistemic failure is noted across numerous other definitions (Slater & Usoh, 1994; Biocca, 1997; Reeves & Nass, 1996; Biocca et al., 2003; Holland, 2003; Lodge, 1999; Lee, 2004) and most notably in the definition of the International Society for Presence Research given here.

Presence…is a psychological state or subjective perception in which even though part or all of an individual’s current experience is generated by and/or filtered through human-made technology, part or all of the individual’s perception fails to accurately acknowledge the role of the technology in the experience…her/his perceptions overlook that knowledge and objects, events,
entities, and environments are perceived as if the technology was not involved in the experience. (International Society for Presence Research)

Cognitive / perceptual presence definitions. An opposing perspective on the conceptualization of presence is the cognitive perceptual definition. Here presence is defined as a cognitive process involving direct perception of currently present stimuli rather than on conceptual processing. Lee (2004) suggested that this is caused by special cognitive mechanisms such as modular and automatic information processing. Similarly, Barfield & Hendrix (1995) defined presence as “[a] ‘cognitive state’ consistent with a sense of ‘being there’ in an environment, a state that results from attending to and evaluating incoming sensory information” (p. 3-16). These definitions assert that cognitive processes directly respond to stimuli in an active and conscious construction rather than maintaining a conceptualization of presence as a more passive and unconscious perceptual illusion.

Sociocultural presence definitions. Another more active and constructionist approach to defining presence is seen in sociocultural definitions of the construct. Mantovani and Riva (1999, 2000) asserted that presence is a cultural-pragmatic construction. While recognizing the perceptual and actional dimensions as defining features of presence, these dimensions and the mediating technologies themselves are considered to be embedded in the sociocultural context. Mantovani and Riva (1999, 2000) conceptualized presence as a product of the action performed in the
environment, where the perceptual stimuli sent to the participants and the technical quality of the interface are but two ingredients (Mantovani & Riva, 1999).

Multidimensional presence definitions. Many scholars from past and present have acknowledged presence as a multidimensional construct (Biocca & Delaney, 1995; Kalawsky, 2000; Sheridan, 1996; Herrera, Jordan, & Vera, 2005; Sanchez-Vives & Slater, 2005; Lee, 2004). Definitions that assert the multidimensional nature of presence are somewhat compilations of the recognized dimensions of earlier more unidimensional conceptualizations. However, multidimensional definitions also view presence as more of a subjective state of being and an interactional response composed of biopsychosocial and behavioral elements. These definitions also recognize presence as a more fluid, variable, and complex perceptual response. Mel Slater (2005) has adopted a critical stance in advancing more multidimensional and response oriented conceptualizations of presence. Sanchez-Vives and Slater’s (2005) definition of presence characterizes this perspective: “[Presence is the] extent to which participants respond to virtual sensory data as if it were real, where responses range from unconscious physiological responses, through behavioral responses, through to feelings, emotions and thoughts” (Sanchez-Vives & Slater, 2005, pp. 332-339).

Dimensions and determinants of presence. As a complex state of being related to the experience with virtual technology, presence, then, has been conceptualized as having multiple dimensions and determinants (Stanney & Salvendy,
1998). There is general convergence in the literature on dimensions and determinants. Yet, despite convergence, diversity of discourse over terminology remains.

Witmer and Singer (1998) and Witmer, Jerome, & Singer (2005) characterized presence as having the dimensions of involvement and immersion. They defined involvement as, “a psychological state experienced as a consequence of focusing one’s energy and attention on a coherent set of stimuli or meaningfully related activities and events” (p. 227). Higher involvement (attention and focus) is theorized here to be associated with an increased sense of presence in a virtual environment. Immersion is considered to be “a psychological state characterized by perceiving oneself to be enveloped by, included in, and interacting with an environment that provides a continuous stream of stimuli and experiences” (p. 227). Higher levels of immersion are theorized to produce a higher sense of overall presence.

Drawing on Sheridan (1992) and Held and Durlach (1992), Witmer and Singer (1998) also proposed factors that influence involvement and immersion categorized as: control factors, sensory factors, distraction factors, and realism factors. Control factors include degree, immediacy, mode, modifiability, and anticipation of events. Sensory factors include sensory modality, environmental richness, multi-modal presentation, consistency of multimodal information, active search, and degree of movement perception. Witmer and Singer (1998) defined distraction factors as interface awareness, selective attention, and isolation factors; and, they defined realism as consistency with the objective world, meaningfulness, and anxiety/disorientation (p. 228-230). Furthermore, presence is thought to be in part
determined by individual qualities. Witmer and Singer (1998) labeled these qualities as immersive tendencies. However, the schemata of immersive tendencies as individual differences that would induce or diminish presence remain under-developed in this work (Witmer & Singer, 1998; Witmer, Jerome, & Singer, 2005).

Others have conceptualized presence with similar dimensions and determinants. While terminology and dimensions exhibit minor variations, dimensions/determinants of involvement, sensory fidelity, immersion, and interface quality are common among other conceptualizations (Witmer et al., 2005).

Scholarship on presence has also led to categorization of the determinants of presence. Ijsselsteijn and Riva (2003) broadly classified the determinants of presence as: (1) media characteristics and (2) user characteristics. Similarly, Slater and Usoh (1993) and Jones (2007) classified media and user characteristics as external (objective) and internal (subjective) determinants of presence (Ijsselsteijn & Riva, 2003). Ijsselsteijn, deRidder, Freeman, and Avons (2000) further subdivided the classification of media factors by the categories of: fidelity of sensory information, match between sensors and display, and content factors or more broadly in later work as form and content variables (Ijsselsteijn & Riva, 2003).

Research on the determinants of presence is in a developing stage. But similar structures of determinants and the multidimensional nature of presence are evident in a growing number of studies (Witmer et al., 2005; Lessiter, Freeman, Keogh, & Davidoff, 2001; Schubert, Friedmann, & Regenbrecht, 2001). Kalawsky (2000) constructed a schematic based on a review of literature detailing media and user
variables related to their contribution and effect on the experience of presence. This matrix details specific sensory and content variables. Conceptual models of the dimensions and determinants of presence have also been offered by Bystrom, Barfield, & Hendrix (1999) with their immersion, presence performance (IPP) model and more recently with Bouvier’s (2008) five pillars of presence model (immersion, interaction, action-perception loop, emotions, and cognition). These models are distinguished by drawing the connection of presence with task performance in the IPP model (Bystrom, Barfield, & Hendrix, 1999) and the shift toward recognition of the role of active cognition related to presence in Bouvier’s (2008) pillars model.

The association of immersion with presence has led to some confusion with the term and concept in the literature; yet, concept clarification has increasingly been recognized. Early in the development of the conceptualization of presence, Slater (1999) and Slater & Wilbur (1997) recognized immersion as a quality of the quantifiable characteristics of the technology to enable a sense of immersion: “the extent to which computer displays are capable of delivering an inclusive, extensive, surrounding, and vivid illusion of reality to the senses of the VE participant” (1997, p. 604). Slater (1999) in a critical challenge to Witmer and Singer (1998) cited the Barfield and Hendrix (1995) study of frame rates and the Welch, Blackmon, Liu, Mellers, and Stark (1996) study of pictorial realism as examples of this conceptualization. Slater (1999) somewhat equates immersion to presence as Witmer and Singer (1998) use the term. This use of the term immersion as an affordance of
technology has had some fixity across technology development related concerns in the 
literature (Bystrom et al., 1999; Draper et al., 1998; Lessiter et al., 2001).

More commonly now is the use of the term, immersion, to denote a user’s 
imersive response to a virtual environment - a sensory response to system stimuli 
and features. This use is derived from the Witmer and Singer’s (1998) concept 
definition. Additionally it is generally recognized that both the media features that 
induce immersion as well as a user’s immersive responses impact presence (Sadowski 
& Stanney, 2002; Jones, 2007). Kalawsky (2000) conceptualized the difference in 
perspectives on the concept of immersion by asserting that immersion refers to the 
physical extent of sensory stimulation as a function enabled by the technology. He 
also distinguished immersion from presence on the basis of presence being considered 
a more cognitive state (Kalawsky, 2000). Research on the role of and influences on 
immersion related to presence conceptualized from either the technology affordance 
perspective or the user response perspective is emerging and is multidisciplinary 
(Banos et al., 2004; Mania & Chalmers, 2001; Bouchard, St-Jacques, Robillard, & 
Renaud, 2008).

The contribution of psychological factors as a determinant of presence has 
been a particular interest in psychology; and, much work has been done in the area of 
human emotions and presence. In a study out of psychology, patients immersed in 
anxiety-inducing virtual environments for phobia exposure therapy treatment 
displayed significantly higher immersion than the patients immersed in the non- 
anxious virtual environment (Bouchard et al., 2008). In another psychological study,
social inhibition was shown to create impaired performance effects in immersive virtual environments (Hoyt, Blascovich, & Swinth, 2003). Form and content as media characteristics were examined in a study of emotional impact of sadness on immersion and presence. Affective content and immersion were both shown to increase presence. However, immersion in this work was shown to be more relevant in the non-emotional virtual environment. Yet the work of Grassi, Giaggioli, and Riva (2008) demonstrated that media content inducing emotional sadness increased the sense of presence while content inducing the emotions of amusement, fear, or neutral content showed no significant differences. Likewise, media form had no significant impact. Riva and Waterworth (2003) theorized that emotions would be associated with higher core presence levels. Emotional impact (social competitiveness) was also shown to increase engagement/immersion and presence in a study of video game players. Arousal and attentional processes were attributed to the increase in presence (Ravaja et al., 2005).

A body of work is also accumulating from computer science and behavioral/social science that identifies individual human characteristics and the impact on immersion or presence. Early work in this area was done by Slater and Usoh (1993) and Slater, Usoh, and Steed (1994). Slater and Usoh (1993) demonstrated that the greater the degree of visual dominance, the higher the user’s sense of presence. In this study the characteristic of auditory dominance was associated with lower presence intensity; and, kinesthetics was inconsistently correlated to presence between experimental and control groups. These results were
corroborated in the 1994 study. Witmer & Singer (1998) demonstrated that the human
tendencies of tendency to get involved (involvement), the ability to concentrate
(focus), and the frequency that subjects play games (games) as qualities of immersive
tendency, were highly correlated with presence. Similarly Banos et al. (2004)
demonstrated that the tendency toward absorption (involvement or immersion) in
everyday events or attentional objects was positively related to presence.

Sas and O’Hare studied individual cognitive factors (absorption, creative
imagination, empathy, and cognitive style) in one study (2003) and cognitive styles in
another study (Sas, O’Hare, & Reilly, 2004). Imagination and empathy were
significantly correlated with presence; whereas, absorption was correlated but did not
reach significance in a small sample of 15 students (Sas & O’Hare, 2003). In the
second study, student users scoring higher for feeling or sensitive personality types
experienced higher intensity presence. Introverted personality types showed this trend
without reaching significance (Sas, O’Hare, & Reilly, 2004). The related personality
quality of inhibition was associated with impaired task performance in the work of
Hoyt, Blascovich, & Swinth (2003).

In a similar work on individual differences, Jurnet, Beciu, and Maldonado
(2005) studied the relationship of five user characteristics (spatial intelligence,
personality, cognitive style, computer experience, and test anxiety) on sense of
presence. Results demonstrated that spatial intelligence, introversion, and anxiety
influenced the sense of presence. Their results on cognitive styles conflict with
Slater’s findings since in this study, no relation between the verbalizer-visualizer
cognitive style and presence was demonstrated; whereas, such a relationship was demonstrated in Slater and Usoh’s (1993) work.

A high concentration of studies has been done on technology specific media forms related to immersion and/or presence especially in relation to industrial design and specific technology development. A detailed synthesis on the status of knowledge regarding media form variables has been completed by Kalawsky (2000). A brief listing of this literature is presented here to display predominant media form characteristics that have been shown to positively or negatively influence immersion and or presence: foreground/background (Prothero, Hofmann, Parker, Furness, & Wells, 1995), realism (Freeman, Avons, Medis, Pearson, & Ijsselsteijn, 2000; Welch, Blackmon, Mellers, & Stark, 1996), tactile or olfactory sensory stimulation cues (Larsson, Vastfjall, & Kleiner, 2001; Slater, Steed, McCarthy, & Maringelli, 1998), field of view (Prothero & Hoffman, 1995; Seay, Krum, Hodges, & Ribarsky, 2001; Ijsselsteijn, deRidder, Freeman, Avons, & Bouwhuis, 2001; Lin, Duh, Parker, Abi-Rached, & Furness, 2002), sound and audio cues (Hendrix & Barfield, 1996a; Vastfjall, 2003), and visual 3D model flickering (Ciflikli, Isler, & Gudukbay, 2010).

**Emerging presence research.** Considering the accelerating evolution of technology, research in this area will continue as new affordances in technology develop. Emerging questions regarding presence related to technology forms such as high fidelity simulation and mobile technologies are only newly being addressed (Arminen, Doskela, & Vaajala, 2008; Alem, Hansen, & Li, 2006; Dieckmann, Manser, & Wehner, 2003; Reintsema, Preusche, Ortmaier, & Hirzinger, 2001). These are
among early research works to be done that consider the mixed reality presence experience.

Arminen, Doskela, and Vaajala (2008) examined the way in which presence is accomplished by air traffic controllers interacting within the context of mobile media simulation. This study showed presence to be a socially achieved state established through talk, gestures, proxemics, and actions that was not entirely dependent on the ontological status of features of the simulation. The authors established that participants demonstrated degrees of presence in relation to action between the in situ environment and mobile contexts in this mixed reality simulation.

Only one study concerning presence and high fidelity human patient simulation was found in the literature (Dieckman, et al., 2003). In this survey of six anesthesiologists participating in clinical simulation scenarios, presence was found to be influenced by user and scenario related factors. User factors included emotions, anticipation, and group dynamics. Scenario factors included technical, task, role, meta view, and action features. The authors constructed a beginning model of factors influencing the experience of presence in HF-HPS scenarios.

*Presence and outcomes.* An important and emerging thread in the scholarship on presence also concerns the impact or outcomes related to immersion or presence in virtual environments. Research related to the relationship of the sense of presence with virtual experiences on task performance and causal perception is building (Witmer & Singer, 1994; Maida et al., 1997; Welch, 1999; Stanney, 2000; Patel et al., 2006; Cavazza et al., 2007; Tichon, 2007; Ragan, Sowndararajan, Kopper, &
Bowman, 2010). Early results seem to indicate a positive impact of presence on task performance and causal perception in these studies. The role of immersive presence in educational simulation and augmented realities related to learning and learning transfer outcomes is also emerging from technology and education studies (Barab & Dede, 2007; Dede, 2005; Dede et al., 2000). Immersive participatory simulations are showing promise in achieving learning outcomes (Barab & Dede, 2007; Dede, 2005). The role of presence and learning outcomes in technology mediated learning experiences is an important area for future inquiry.

Other outcomes research is being done in the area concerning the impact of presence in virtual environments on memory and recall (Mania & Chalmers, 2001; Denny & Atkin, 2006; Ragan et al., 2010). Results in this area are inconsistent. The Denny and Atkin (2006) study demonstrated a positive impact of presence on factual recall. Similarly, higher immersion resulted in higher performance levels from tasks memorized in a 3D simulation environment in the Ragan, Sowndararajan, Kopper, and Bowman (2010) study. Yet, Mania and Chalmers (2001) investigated levels of immersion and reported that presence related to memory recall and memory awareness state showed uneven results between memory recall or task performance in real versus virtual conditions. Higher presence was reported in the real versus virtual condition but this difference did not carry through to task performance and memory recall. The authors cited issues with measurement using questionnaire as a partial contributing factor.

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Presence intensity. The issue of presence intensity has been conceptualized in different perspectives. Biocca (1997) viewed the experience of presence as occurring in exclusive modes. Yet, Draper, Kaber, and Usher (1998) asserted that presence is experienced on a scale of varying intensity. Similarly Rettie (2004) saw presence as being on a continuum and as a framed experience. Still, Ijsselsteijn (2002) viewed presence as a state of consciousness where a person is able to experience more than one environment at a time at varying intensity. By this Ijsselsteijn is asserting that users perceive both the primary physical environment and the virtual environment as distinct entities where the user experiences shifts in attention between the environments leading to a sense of presence that would be experienced in levels of intensity. This could be further conceptualized where the user experiences a sense of presence where the virtual environment is salient while the user is still aware of the proximal environment but with lower salience.

Presence intensity raises questions regarding what happens when there are breaks in the sense of presence during a virtual experience. Breaks in presence (BIPs) were originally proposed by Slater and Steed (2000). Brogni, Slater, and Steed (2003) further defined a break in presence as the state when the participant stops responding to the virtual stream and instead responds to the stimuli from the real sensory stream. Research on breaks in presence is emerging (Brogni, Slater, & Steed, 2003; Spagnolli & Gamberini, 2002; Garau et al., 2008). This work has shown that the number of breaks in presence may reduce global presence in virtual experiences (Slater & Steed, 2000; Brogni et al., 2003) and that BIPs have causes such as distractions in the simuli,
environment or interaction from the virtual field (Garau et al., 2008). Rey, Tembi, and Alcaniz (2010) also demonstrated a physiological response (cerebral blood flow velocity) to breaks in presence. Questions remain concerning how the level of intensity of immersion or presence or how breaks in presence impact participants’ experiences or outcomes related to simulations.

Ijsselsteijn’s (2002) conception of presence and the work on presence intensity (Brogni et al., 2003; Spagnolli & Gamberini, 2002) also raise a challenge to the notions of non-mediation and the suspension of disbelief as determinants of presence in virtual experiences. Users remaining aware of the natural environment are certainly aware, then, of the artificiality of the virtual environments. It is therefore logical that there is a greater role of intentionality or agency involved in the willing engagement or suspension of disbelief in artificial reality. Work in these areas has been started. Blake, Nunez, & Labuschagne (2007) reported on the longitudinal effects on presence and challenged traditional notions on suspension of disbelief. Herrera, Jordon, and Vera (2005) suggested that agency plays a necessary role enabling a subjective stance and the capacity of experiencing presence.

Both questions related to presence intensity show a shift in the direction of future research to a greater emphasis in trying to understand presence as a more actively constructed state of being where cognition and agency may be more determinant of presence than originally conceptualized in the theorized structure of presence. Turner (2007) has conceptualized a newer model of presence as a product determined by a dynamic between intentionality and affordances. Spagnolli and
Gamberini’s (2002) work also stimulates questions around the issue that presence in simulation may not preclude aspects of the real world. This raises questions concerning exploration of levels of reality represented in simulation and levels of immersion and presence as mediators on the human experience in virtual applications particularly when used for education and training.

Much of the expectation of virtual simulation is built on achieving realism and the assumption of the user being present in the simulation experiencing the environment as real. If the presumption is, that the user of a virtual environment also experiences the natural environment with some amount of salience, then it is logical to assume that users are quite aware of the artificiality of the situation. Is it then a richer experience to capitalize on a hybridity of the virtual and real experience as Spagnolli and Gamberini (2002) suggest? Alternatively, would emersion from the virtual environment diminish the value of the experience? In addition, does the user’s awareness of the artificiality of virtual experiences preclude the sense of burden of consequence on actions? These are fruitful areas for inquiry related to presence in the application of virtual experiences especially in the areas of education and training and in particular in the application to HF-HPS.

**Measurement of presence.** Presence is a multi-dimensional, complex, subjective and, therefore, elusive human phenomenon. As a psychological construct, presence may even be epiphenomenal (Sadowski & Stanney, 2002; Welch, 1999; Ellis, 1996). Furthermore, presence is also context dependent. The nature of the experience of presence having variable salience of the psychological, cognitive, social,
and behavioral/actional dimensions is determined by the affordances of the virtual technology as well as the user characteristics and intentionality. Coupled with the accelerating development and diverse features of virtual technology, presence is also then a fluid and situated human experience. The difficulties in conceptualizing the dimensions of presence have consequently led to difficulties in measurement. Both subjective and objective measures have been utilized with varying degrees of success.

As a subjective human phenomenon, the primary method of measurement has been by subjective report by post-test questionnaires and rating scales. These measures require participants to recall their conscious experience with the virtual environment and to make an introspective judgment about questions that inquire about dimensions and determinants of presence (ISPR, 2000). Multiple questionnaires and subjective instruments have been developed and many have established reliability and validity. Established instruments have been assembled in a compendium to guide presence research (van Baren & Ijsselsteijn, 2004; 2005). Presently, the compendium lists 31 instruments covering diverse virtual contexts. Most notable among these instruments are: Witmer and Singer’s (1998) Presence (PQ) and Immersive Tendencies (ITQ) instruments; Lessiter, Freeman, Keogh, and Davidoff’s (2001) ITC-SOPI Sense of Presence Inventory; Slater, Usoh, and Steed’s (1994) SUS questionnaire; Lombard and Ditton’s (2000) Physical and Social Presence Questionnaire; Nowak and Biocca’s (2003) Physical and Social Presence instrument; and, DeGreef and Ijsselsteijn’s (2001) IPO-SPQ Social Presence Questionnaire.
Questionnaires and subjective measures instruments may be valid and reliable measures of presence. These measures offer ease of administration, low cost benefit, and an unobtrusive format. However, these instruments are often oriented to specific virtual contexts. Differences in instruments and contexts make comparisons across studies difficult. A more important consideration related to the validity of this form of presence measurement is the state of presence itself. While these instruments offer face validity, the difficulty defining presence evidenced in the literature calls into question whether these instruments are getting at the complex nature of the presence experience. Presence is not a well known or understood experience among the general public. Therefore, participant responses may not be valid (ISPR, 2000). The act of introspection, recollection, and timing of testing may also produce unstable or inconsistent responses (Freeman et al., 1999; Insko, 2003; Bemardet et al., 2008).

Evidence of the uncertainty of using survey measurement exists in the literature. Usoh, Catena, Arman, and Slater (2000), from their work, contend that survey measurement could not detect an assumed increase in presence, may not be able to detect presence intensity, and may have questionable utility across environments. Others have expressed concerns over the limitations of survey measurement of presence as a complex construct (ISPR 2000; Insko, 2003; Sadowski & Stanney, 2002). Slater (2002, 2004) has recently offered serious challenge to the validity of using questionnaires as a unitary measure of presence on the basis of the elusiveness and complexity of the construct. Early on, he engaged in a rather contentious and public argument (Slater, 1999) against Witmer & Singer’s (1998)
questionnaire. More recently Slater has changed tone using rather creative tactics to illustrate this point by calling presence the “sixth sense” (Slater, 2002), offering an invented study concerning the degree of “colorfulness” in one’s day (Slater, 2004), and suggesting a new paradigm for measuring presence using physiological and behavioral data alongside subjective survey data (Slater & Garau, 2007).

Objective behavioral and biophysical measures have also been used to measure presence; but, these methods have also brought challenge to measuring presence. Behavioral and biophysical measures are quantifiable but are highly dependent on the virtual context. These measures are based on the premise that users that experience greater presence in a virtual environment will respond with objectively measurable behaviors or physical responses to stimuli and affordances of the environment. Various studies cited in the OmniPress Compendium (vanBaren & Ijsselsteijn, 2004, 2005) have used such parameters as: facial expression (Huang & Alessi, 1999); bodily movement or body positioning (Freeman et al., 2000); reflex responses (Nichols, Haldane, & Wilson (2000); heart rate (Dillon, Keogh, Freeman, & Davidoff, 2000), skin temperature (Meehan, Insko, Whitton, & Brooks, 2001); ocular measurements (Laarni, Ravaja, & Saari, 2003); electromyography (EMG) (Ravaja, 2002); electroencephalogram (EEG) (Schlogl, Slater, & Pfurtscheller, 2002); magnetic resonance imagery (MRI) (Hoffman, Richards, Coda, Richards, & Sharar, 2003); and task response behaviors (Slater, Linakis, Usoh, & Kooper, 1996). Challenges with measurement of presence using behavioral and physiologic measures include the
choice of an appropriate measure to indicate presence and understanding whether the parameter is a direct result of the experience of the virtual environments (Insko, 2003).

Other subjective measures of presence have been cited in the literature (vanBuren & Ijsselsteijn, 2004, 2005). These include paired comparison of stimuli, equaling responses in different modalities termed cross-modality matching (CMM), memory measurements, awareness, and breaks in presence measures (vanBuren & Ijsselsteijn, 2004, 2005). These subjective, corroborative measures are highly context dependent. Thus, task performance measures are increasingly being used as a measure of presence particularly in simulation research.

Becoming of greater interest now is the potential contribution of qualitative methods for the measurement of presence (Turner & Turner, 2007; vanBuren & Ijsselsteijn, 2004, 2005). Credit is being given to the potential of qualitative methods to capture the richness, complexity, and situated nature of the presence construct (Turner & Turner, 2007). The OmniPres Compendium on presence measurement lists a variety of qualitative measures that have been used in the literature including content analysis (Rourke, Anderson, Garrison, & Archer, 1999), ethnographic observation (McGreevy, 1992), focus group (Freeman & Avons, 2000), retrospective self report (Turner et al., 2003), interaction analysis (Spagnolli, Varotto, & Mantovani, 2003), and interview (Murray, Arnold, & Thornton, 2000). VanBuren and Ijsselsteijn (2004, 2005) suggested that for measurement of presence in virtual contexts, qualitative measures would likely be high in validity but may pose challenges to comparisons
within or across studies. Understanding how to achieve the most sensitive measure continues to present challenge in studies of presence in virtual contexts.

**Assumptions on reality in virtual environments and presence.** Definitions of presence and methods of measurement are embedded in ontological and epistemological positions. Mantovani and Riva (1999) asserted that the meaning of presence depends on the concept of reality that is held and that different ontological positions would generate different conceptualizations of presence and approaches to measurement. Similarly, Zahorik and Jenison (1998) and Sheridan (1999) agreed that “ontologic views underwrite what presence is defined to be, what determinants of presence are and how presence may be measured” (Zahorik & Jenison, 1998, p 79).

The representation of reality in simulation is the ontological domain and is, as referred to earlier, a determinant of presence in virtual reality. The extent to which the virtual reality or simulation match the intended reality of which it represents is termed fidelity (Lathan, Tracey, Sebrechts, Clawson, & Higgins, 2002). It is widely held that the closer the virtual represents the intended, actual environment, the more it may induce a sense of presence that would then lead to skill acquisition and learning transfer (Mantavoni & Castelnuovo, 2003; Lathan et al., 2002).

The notion of this relationship between fidelity and learning is based on the theories of mental conditioning where exercise of general faculties of the mind lead to broad transfer (Angell, 1908) and on the theory of identical elements and the specificity of learning where transfer occurs when two tasks share identical elements (Thorndike, 1906). Singley and Anderson (1989) asserted that while transfer does
exhibit specificity, a specific match is too restrictive. Instead they theorized that transfer occurs when situations exhibit the same logical structure. Since this historical context, it is further recognized that while high fidelity may be a key determinant of presence and learning transfer, other domains such as motivation, interactivity, emotions, reflection, and narrative also may significantly contribute to learning outcomes. Heeter (2001) illustrated this point with the assertion that: “even a perfect mediated sensory perception would not by itself automatically induce a strong sense of presence because reality [itself] does not automatically induce a strong sense of presence” (p. 1).

Yet, there is a lively debate present in the literature asserting ontologic positions related to presence (Zahorik & Jenison, 1998; Flach & Holden, 1998; Sheridan, 1999; Mantovani & Riva, 1999; Lauria, 2001; Sheridan, 2001; Mantovani & Riva, 2001). Evident in these positions, however, is a lack of acknowledgment concerning the connection of ontology and epistemology underpinning an understanding of presence as an experience concerning the interface among humans, technology, and phenomena of the world. In fact, most perspectives asserting ontological positions in this discourse are actually debating epistemological perspectives (Biocca, 2001).

The experience of presence in virtual reality or simulation stands between what is of an ontological nature and what is of an epistemological nature. Presence mediated by virtual environments is at first an epistemological concern, the conscious process of perception; but, virtual reality calls upon the user to negotiate between that
which is natural, the reality represented, and that which is produced in a simulated or artificial form - this being the ontological concern. The meaning in the term virtual reality itself suggests this very connection. So the fundamental question with presence in virtual reality and in particular with simulation is: what is the nature of the reality that is produced and how is that representation perceived and acted upon - this being a potential dimension of the nature of presence.

**Presence in High Fidelity Human Patient Simulation and Nursing Education**

Presence as a construct appears not to have been defined and studied in relation to simulation or technology mediated instruction in nursing education as of the time of this writing. This is likely related to the relative newness of the application of high fidelity human patient simulation to nursing education. Yet, presence has long been an important concept in the context of therapeutic nursing care. Although, presence in the nursing care context carries a slightly different connotation. Presence in nursing follows from the Latin derivative of the term, *praesetia*, meaning, “to be present –as with others” (Random House, 2010) and as a form of the word *praesse*, meaning “to be before” as in to be at hand for the help of others and in the sense of bearing a gift (Harper, 1991). Presence in nursing then has a connotation of the sense of “being with” for the aid and benefit of another; whereas, presence in the context of virtual reality or simulation has meant “being there.”

Paterson and Zderad (1976) are generally credited with delineating the centrality of presence in the nurse-patient relationship through their existential, phenomenological, and humanistic philosophy of nursing. They defined presence as
“a mode of being available or open in a situation with the wholeness of one’s unique, individual being; a gift of the self…be[ing] given freely, invoked or evoked” (1976, p. 132). Presence is conceptualized by these nursing theorists as the nurse using the self through dialogue, empathy, interaction, and transactions in a therapeutic, psychological milieu as an intervention to meet the patient’s need for help, comfort, or support (Patterson & Zderad, 1976; Bulechek & McCloskey, 1985). Furthermore, Patterson and Zderad (1976) conceptualized nursing presence as a state of “being with” a patient, a behavioral expression were presence involves attention, awareness, and interaction in an active mode of being there in the situation. Since this original articulation, presence has now been fully articulated in nursing (Gardner, 1992; Osterman, & Schwartz-Barcott, 1996; Easter, 2000), is a recognized nursing intervention in the Nursing Interventions Classification (NIC) taxonomy, and is defined as, “being with another, both physically and psychologically, during times of need” (Bulechek, Butcher, & McCloskey Dochterman, 2008, p. 584).

Jean Watson’s noted Philosophy and Science of Caring originating in 1979 has been classified as a grand theory or global paradigm of nursing science (Reed & Shearer, 2011). Her work presents an ever-expanding philosophy and theory of caring in nursing of which presence is a central dimension. Watson’s theory (1979, 1999, 2005, 2007) defines nursing as a caring science grounded in the transpersonal and intersubjective interaction of “being-in-relation” with the lived world of the experiencing person. In Watson’s view, the nurse is a “co-participant” in a process by “helping a person find meaning in illness, suffering, pain, and existence; to help
another gain self-knowledge, control, and self-healing wherein a sense of inner harmony is restored…” (Watson, 2007, p. 54).

Watson’s theory identifies 10 carative factors forming the core of nursing. In her 2005 articulation of the theory, these factors are transposed into what is termed, clinical caritas (Watson, 2005). In this process, the centrality of presence is noted in specific and implicitly throughout as evidenced in the following articulation of the caritas process (Watson, 2005, p. 4):

1. Practicing loving-kindness and equanimity within the context of the caring consciousness.
2. Being authentically present and enabling the deep belief system and subjective life world of self and one-being-cared-for.
3. Cultivation of one’s spiritual practices and transpersonal self, going beyond the ego self.
4. Developing and sustaining a helping-trusting, authentic caring relationship.
5. Being present to and supportive of the expression of positive and negative feelings in connection with the deeper spirit of self and the one-being-cared-for.
6. Creative use and all ways of knowing as part of the caring process; to engage in the artistry of caring-living practices.
7. Engaging in genuine teaching-learning experience that attends to unity of being and meaning, attempting to stay within the frame of reference.
8. Creating a healing environment at all levels (physical, nonphysical, subtle
environment of energy, and consciousness), whereby the potentials for wholeness, comfort, dignity, and peace are actualized.

9. **Assisting with** basic needs with intentional caring consciousness, administering “human care essentials” that potentiate alignment of mind-body-spirit, wholeness, and unity of being in all aspects of care.

10. **Opening and attending** to spiritual-mysterious and existential dimensions of one’s own life-death for self and the one-being-cared for.

The nature of presence in nursing, then, encumbers an expansion of the conceptualization of the construct of presence when applied to the application of and the study of presence in the context of HF-HPS. Presence in this technology mediated context needs to be conceptualized as both “being there” in the simulation environment perceiving, experiencing, and acting on the health care situation in an instrumental sense but also as the sense of “being with” in the simulation context perceiving, experiencing, and acting in a more psychosocial, transpersonal, and interactional sense. Furthermore, presence in HF-HPS would imply cue recognition and a sensitivity to human needs paired with a sense of moral duty and professional encumbrance bearing a fullness of weight of responsibility, accountability, and altruism to help, aid, and intervene on behalf of another human being – this being a therapeutic, agentic consciousness.

The rapidly expanding use of HF-HPS in nursing education makes imperative to develop and support best practice pedagogy to guide its use with the aim of developing nurses for their caring professional role. Experiential learning in nursing
requires an engaged learner to achieve intended learning outcomes (Dreyfus & Dreyfus, 2009). HF-HPS is a technology mediated, experiential learning where the mode of engagement is through presence in the simulation context. Research on presence, therefore, would support pedagogy aimed at inducing and supporting presence in the HF-HPS context. Presence in the context of HF-HPS then offers the potential of fostering important learning goals such as instrumental task performance, clinical agency, and learning transfer.

Learning transfer refers to the effectiveness of training to support performance when faced with similar circumstances in the real environment (Mantovani & Castelnuovo, 2003; Lathan et al., 2002). The primary rationale for the use of simulation or virtual environments is for the possibility of achieving task performance in real life circumstances. Learning transfer is based on theories of learning by identical elements (Thorndike, 1906) and general conditioning of the mind (Angell, 1908) when by either mechanism, skill acquisition is gained through training that mimics the actual situation as closely as possible and is then able to transfer to the real performance environment. Presence is considered to be a key dimension “to ensure the efficacy of training” (Mantovani & Castelnuovo, 2003, p. 168). The results of this research support greater understanding of pedagogy that could induce the sense of presence that may also improve the likelihood of successful learning transfer to the live clinical situation.

Perhaps the primary importance of presence in clinical simulation is in its ability to induce and foster agentic consciousness and clinical agency. As discussed
earlier, the agentic consciousness is the dimension of presence of the nurse as the self in the caring professional role. The social and interactive elements in HF-HPS may foster the development of carative values and behaviors in the nurse. Benner, Tanner, and Chesla (2009) defined clinical agency as “the experience and understanding of one’s impact on what happens with the patient and the growing social integration as a member and contributor of the health care team” (p. 39). Clinical agency not only entails recognition of clinical needs, knowledge of care requirements, clinical judgment, and assertiveness to act, but also is a matter of the sense of accountability and responsibility for the patient’s condition, awareness of the range of choices on interventions, sense of salience for what demands focus and attention, and the moral sensibility to navigate complex situations as the nurse develops from novice to expert practice (Benner, Tanner & Chesla, 2009).

Presence, then, in the context of HF-HPS is a highly situated state of being in interaction. As this literature review reveals, simulation has become increasingly variable and complex where the boundaries between the natural and the virtual are less distinct. HF-HPS is a mixed reality context in which the presence state of being is experienced. The nature of HF-HPS, then, as a situational phenomenon oriented this study toward a method that would account for the context of the situation.

**Conclusion**

As demonstrated in this literature review, conceptualizations of presence have moved toward greater complexity. Presence as an interactional phenomenon is
inherently embedded in the context of the interaction. Thus, much as the virtual context has moved in complexity or hybridity, presence definitions have also moved to accommodate the differences and the impact of the context. In the context of real or natural interactions, unmediated by virtual contexts, presence is conceptualized as a transpersonal state of being in interaction; whereas, in the virtual context, presence moves toward more agentic or multidimensional conceptualizations. The recognition of the importance of context related to the nature of presence sensitized this inquiry toward a conceptualization of presence and required a method of inquiry that also would account for the contextual or situational nature of the interaction.

Contributing also to the context of interaction of which presence in HF-HPS would be experienced is also the nature of nursing. In HF-HPS, students enact the role of the professional nurse. The professional role places the nurse in a caring interaction with a patient in a health care situation. The nature of presence in this context requires a sense of “being with” another for the therapeutic benefit of the other – a caring agentic consciousness. Recognition of the nature of the nurse – patient relationship, also sensitized this inquiry toward a situational conceptualization of the nature of presence taking into account not only the multidimensional nature of presence but also the transpersonal nature of presence. This situational conceptualization of presence in the context of HF-HPS emerged from the results of this study; is developed in Chapter 4; and, is fully articulated in Chapter 5.

The sensitization to the embeddedness of presence in the context of HF-HPS and to the nature of the nursing role gained from the literature review oriented the
methodology toward a constructivist or situative approach to grounded theory. At the core of grounded theory is an emphasis for “the need for developing many concepts and their linkages in order to capture a great deal of the variation that characterizes central phenomena studied” (Strauss, 1987, p. 7). Grounded theory has also similarly moved from its original orientation under Glaser & Strauss (1967) toward an accounting for greater complexity in the study situation under the grounded theory orientations of Charmaz (2006) or Clarke (2005). In Chapter 3, the parallel moves of grounded theory intellection to an accounting for greater complexity are traced to substantiate the consistency of the methodology with the assumptions around the phenomena of study. Following this in Chapter 3 is presented the application of grounded theory in this study.

As yet, little is known about how HF-HPS may shape the nature of nursing education and ultimately nursing practice. We know little about how nursing students perceive the human health care context learned by simulation or how learning by HF-HPS may impact nurse-patient interactions, clinical care, and patient outcomes. Presence, the participant’s state of being in interaction with a simulation, is the means by which participants experience the reality of the human condition represented in HF-HPS. The findings of this study of presence in HF-HPS are important to the ontological and epistemological concerns present in the application of HF-HPS in nursing education. “Body work is ‘sacred’ work that [engages] nurses to share with patients intimacies unknown to other health care providers” (Sandelowski, 2000, p. 10). It is therefore a professional responsibility and a moral imperative in the
discipline of nursing to seek this understanding for the potentially profound contribution that HF-HPS may have on the development of nursing care professionals for their role in serving society’s health care needs. The development of the conceptual model of the nature and determinants of presence in HF-HPS presented in Chapter 4 provides a beginning foundation for this work.
Chapter 3: Methods

What does simulation want? On one level, ...the question is simple:
simulations want, even demand, immersion...Immersed in simulation, we feel
exhilarated by possibility....But immersed in simulation, we are also
vulnerable. Sometimes it can be hard to remember all that lies beyond it, or
even acknowledge that everything is not captured in it. (Turkle, 2009, p. 6-7)

Introduction

Methodologies are derived of the socio-cultural, historical, philosophical,
organizational, economic, and political underpinnings of which they are born and
practiced. It is, then, increasingly acknowledged that methods and scientific research
practices are never neutral (Kuhn, 1962) and that methods privilege findings (Law,
2004). Furthermore, methods produce the reality that is understood and the
knowledge that is constructed. Drawing on Foucault, methods produce the conditions
of possibility to know (Law, 2004). Method assemblage makes possible and enacts
boundaries between what is presenced, what is made absent (Law, 2004; Heidegger,
1952/1977), and what is otherwise possible (Law, 2004). What is produced as reality,
then, is constitutive of the method assemblage (Law, 2004).

The importance here is that if the social world is taken to be multiple, complex, fluid, diffuse, and indefinite, then scientific practices need to have means to apprehend such a state of complexity. Advocating for broadened methods, Law (2004) puts it this way, “…if we want to think about the messes of reality at all then we’re going to have to teach ourselves to think, to practice, to relate, and to know in new ways” (p. 2) where we have: concern for ontological process, means to apprehend multiplicity/fractionality, recognition of the ways in which method manifests presence, absence, and othering, and method assemblages sensitive to the indefinite and the flux of things (Law, 2004). In other words, there is a need to seek methods that interweave the relations, resonances, interconnections, and interferences of the studied world (Law, 2004).

Grounded theory stands notably as an influential methodology in the advancement of qualitative inquiry. The evolution of intellection of grounded theory methodology has achieved durability and relevance across paradigmatic shifts, disciplinary boundaries, and phenomena of inquiry in its movement through objectivist, constructivist, and post structural orientations. Evidenced through four distinct moves in the intellection of grounded theory is an increasing accountability for the interwoven context, multiplicity, and complexity related to phenomena of the social world.

A tracing of moves in the orientation of grounded theory in this chapter reveals a shift in perspectives on human agency as well as an increasing appreciation of
context around social phenomena across this evolution of intellection. This is coherent with the assumptions around the phenomena of interest in this study.

Presence was assumed in this study to be highly embedded in the HF-HPS context. The nature of presence was also assumed to be situated in the nurse - patient care relationship bearing not only the multiple dimensions of immersion, engagement, perception, and cognition but also the situated dimension of a caring, agentic consciousness.

Chapter 3 presents an examination of the assumptions, benefits, limitations, and rigor of grounded theory across the evolution of intellection and orientation within classical and second generation grounded theory. Emphasis is placed on the intersections and disruptions in the methodologic orientations among Glaser, Strauss, Charmaz, and Clarke and the shift in perspectives on human agency as well as an increasing appreciation of context around social phenomena across this evolution of intellection. A discussion of the theoretical orientation underpinning this grounded theory inquiry is also presented. Following this background is a presentation of the application of a second generation, Charmazian grounded theory to this study concerning the nature and determinants of presence of nursing students participating in high fidelity human patient simulation. A description of the assumptions and the procedures of sampling, data collection, and analysis are presented. Measures undertaken for the rigor of the research process are also discussed.
Classical Grounded Theory

The intellectual orientation of grounded theory (GT) has evolved from its roots originally articulated in the classic works of Glaser and Strauss (1965, 1967), Glaser (1978), and further, yet divergently advanced by Glaser (1998, 2007) and Strauss and Corbin (1990, 1997). Most recently a second generation of grounded theory has been given a more post modern conceptualization through the framing of Charmaz (2000, 2006, 2009) and through Clarke’s (2005) reframing and extension of grounded theory to situational analysis. These four moves have brought GT further from its original articulation with more objectivist and post-positivist paradigmatic assumptions under Glaser and Strauss to Charmaz’s (2006) more constructivist and to Clarke’s (2005) more post structural orientations while still maintaining much of the strength of GT’s logic and methods. These icons of GT are most strongly identifiable with the evolution of intellection; yet, acknowledgment must also be given to the many others (Chenitz & Swanson, 1986; Hutchinson, 1986; Williams, 1989; Schatzzman, 1991; Wuest, 1995; Stern, 1980, 1985, 1994, 2007; Schreiber, 2001; Schreiber & Stern, 2001; Covan, 2007; Bowers & Schatzman, 2009; Morse, 2001, 2007; Morse et al., 2009) that have made and continue to make significant contributions to the definition, redefinition, and transformation of GT. An overview of the four primary moves in the evolution of intellection and orientation to grounded theory is presented here and is summarized in Table 2 on page 139.
**Glaserian Grounded Theory.** In its original conceptualization, GT espoused positivist-post-positivist ontology and epistemology. Known now as Glaserian grounded theory, under Glaser and Strauss (1965, 1967) and Glaser (1978), this grounded theory approach would seek to produce explanatory theoretical frameworks through conceptual understanding of extant phenomena. The ontologic assumption under a Glaserian (1978) approach would view reality as extant and to be discovered emerging out of data derived of a direct and rather narrowly applied empiricism (Charmaz, 2006; Clarke, 2005). Glaser and Strauss (1967) took an objectivist epistemologic position of discovering theory emergent from the data about phenomena as given and existent separate from the researcher observer (Charmaz, 2006).

The foundational methodology of grounded theory has been relatively durable over the evolution of intellection. This method is a systematic, yet flexible heuristic for qualitative research practice. The methodology aims to generate abstract theoretical explanations, substantive or formal theories, of basic social processes. Theory is derived from an inductive logical thrust applied to emergent data concepts. Grounded theory moves beyond description toward conceptual level analysis and into the sphere of explanatory theoretical frameworks (Glaser & Strauss, 1967; Glaser, 1978; Charmaz, 2006).

The classical defining grounded theory methodology includes somewhat prescriptive processes and analytics. Glaser’s more quantitative training from Columbia University is evident in his orientation toward codifying qualitative research methods (Charmaz, 2006). The empirics revolve around simultaneous and systematic
involvement in data collection and analysis directed toward theory construction according to the following framework originally put forth by Glaser & Strauss (1967), Glaser (1978), and reaffirmed by Charmaz (2006) and Clarke (2005).

1. Constructing analytic codes emergent from data (open coding).
2. Constant comparative analysis and selective coding.
3. Densifying related codes into conceptual categories (theoretical coding).
4. Memo writing to elaborate categories, define relationships between categories, and to identify gaps.
5. Iterative process of sampling toward theory construction (theoretical sampling).
7. Delayed literature review.

Grounded theory maintains flexibility toward specific data collection methods. At its inception Glaser and Straus (1967) envisioned a framework that would be flexible to accommodate inquiry concerning diverse social processes and disciplinary perspectives. This openness to various forms of data and collection methods has allowed GT to achieve its long standing and wide spanning applicability. Glaser referred to GT as a “general method of analysis” applicable to any form and combination of data collection (Glaser, 1978, p. 6). Transcending data collection methods, GT is directed at qualitative inquiry; however, Glaser acknowledged extension of the methodology to quantitative data through an adaptation of Lazarsfeld’s elaboration analysis (Lazarsfeld & Rosenberg, 1955).
Glaserian grounded theory presents a rather detailed analytic consisting of three levels of coding and the process of constant comparative analysis followed by theoretical elaboration with a framework of eighteen coding families. The analytic begins with open coding where the aim is to generate emergent concepts through line by line or incident by incident analysis that Glaser (1978) referred to as fracturing the data. Next, a core concept is identified. Unique to the GT analytic is the process of constant comparative analysis and strategy of theoretical sampling. Here, selective coding is used to delimit coding to concept-indicators; whereby, continued sampling, known as theoretical sampling, and data collection are focused around dimensions related to the core concept. Glaser (1978) termed this, the concept indicator model. An iterative process of theoretical sampling for core concept indicators/dimensions followed by analysis comparing different people, concept to concept, concepts to indicators, and indicators to indicators, raises the level of abstraction from concepts to categories and theoretical codes. Theoretical sampling is directed at elaborating and refining key categories until theoretical saturation is achieved (Glaser, 1978; Charmaz & Bryant, 2008). Integration of codes for theoretical analysis is accomplished through the analytic of the eighteen coding families generating a substantive theory around the core category (Glaser, 1978). Memo writing is embedded throughout the analytic process and is fundamental to stimulating theoretical sensitivity of the analyst.

Axiology, the role of values (Hiles, 2008), is an increasingly focal area in qualitative research but was paid less attention outside the notion of right conduct in research in the classical Glaserian era of GT methodology. Yet, axiology as it now
would concern issues of the value laden nature of inquiry and positionality of the researcher (Creswell, 2007), while not directly referred to in the classical framing of GT, can be extracted from the original works of Glaser and Strauss (1967), Glaser (1978), and from critiques of their work in the literature.

GT was at once a move away from the positivist paradigmatic assumptions of objectivity, universality, determinism, systematized methods, unitary stable external reality, generalizable knowledge, and the hypothetico-deductive logic routinized in quantitative methods. Glaser and Strauss (1965, 1967) made a revolutionary challenge contesting the dominance of scientism as the mode of inquiry by asserting the value and legitimization of a qualitative method grounded in an inductive logic directed at studied human action and experience (Charmaz, 2006; Clarke, 2005). Yet, having to justify GT against the prevailing positivist paradigm, a residual positivist values orientation remains in the classical assumptions of GT. Glaserian GT maintains a researcher position of an outside, objective expert. Glaser’s notion that all knowledge is not perspectival (Glaser & Strauss, 1967) alludes to privileging the researcher position.

Considering respect and human dignity, Glaser and Strauss (1967) have also been criticized for a “smash and grab” data collection strategy that is unaccountable to a rapport with participants and that would now be considered lacking due respect and an issue of credibility (Dey, 1999). Classical GT demonstrates a separation of facts from values in the researcher’s outsider, expert position as insightful, all-knowing discoverer and in the assumption that the analytic process of abstraction would control
researchers’ preconceptions and disciplinary biases from imposition. There is also a notable lack of focus on the value of the analyst’s engagement in reflexivity despite the extensive use of memoing in the analytical process. Memoing is instead aimed at theoretical sensitivity and not researcher reflexivity.

**Straussian Grounded Theory.** While Glaser’s orientation to GT has remained fundamentally consistent across time and subsequent writing, Strauss and Corbin (1990), while still maintaining the basic methodology, advanced a divergent orientation that presaged the second generation, constructivist move on GT. Strauss’ Chicago School background in pragmatism, social ecology, and symbolic interactionism underlies this second classical move on the intellection of grounded theory (Clarke, 2005; Charmaz 2006; Bryant & Charmaz, 2007). This Chicago School heritage is clearly evident in the paradigmatic assumptions of the Straussian iteration of GT.

The Straussian ontologic perspective is largely built on Symbolic Interactionist Theory with the assumptions that reality, the self, and society are constructed through interaction. This view is further characterized by the notion that interaction is an inherently dynamic and an interpretive process that construes how persons create and enact meaning and action in their social world (Charmaz, 2006). Strauss’ position on social reality is further influenced by social worlds/arenas theory. For him, social reality is embedded and conditioned upon interactions in the context of larger social processes (Clarke, 2005). In this framework, individuals are considered part of collectives that are constituted through participation and commitment (identity and
predisposition to act), in social worlds and arenas. Here the focus on the nature of social realities is concerned with the social/organizational ways in which identities are produced and transformed through participation in relations and actions in the social world (Charmaz, 2006; Clarke, 2005). Furthermore, in Strauss and Corbin’s (1990) view, social worlds have primary activities that once involved, stimulate more formal organizations to develop to further the aspect of that social world (Clarke, 2005). Persons are then constituted through interaction with social collectives; and, collectives are constituted though interaction with other collectives (Clarke, 2005) where social reality is interactionally created and symbolically represented.

It follows, then, that Straussian epistemology moves toward interpretation with the aim of conceptual representation and provisional verification. Strauss and Corbin (1990) affirmed this in their proclamation that their iteration of GT is comprised of interpretive work (Charmaz, 2006). Strauss viewed human beings as active agents in the social world. This action oriented perspective on human agency coupled with his focus on problem-solving reflects his pragmatist philosophical orientation (Charmaz, 2006). Yet, post-positivist assumptions still remain in the researcher positioning under the Straussian framework. Strauss and Corbin (1990) continued a slight objectivist epistemologic position by the researcher positioning as outside observer, discoverer, interpreter, and re-constructor of social action and by not addressing issues of researcher interaction and reflexivity.

Strauss’ grounding in symbolic interactionist and social worlds/arenas theories is influential on the Strauss and Corbin (1990) methodologic framework. Strauss and
Corbin’s (1990) conception of GT maintains flexibility on data collection methods and the classical process of an inductive logic, coding, memoing, and theoretical sampling; yet, they introduced axial coding and emphasized a divergent analytic giving less attention to emergence and the technique of constant comparative analysis (Charmaz, 2006; Strauss & Corbin, 1990).

Social worlds/arena theory, as put forth in Strauss’ conception of “negotiated ordering” of the social, is the basis for his advancement and departure on the GT analytic (Clarke, 2005). Strauss advanced the analytic framework of GT away from Glaser’s (1978) eighteen coding categories while still maintaining a version of Glaser’s (1978) ‘Six C’s’ coding family evident in what Strauss and Corbin (1990) term the paradigm model. Strauss and Corbin (1990) also included analysis of the structural forms and processes that condition human action. This is given in evolving versions of what they termed, conditional matrices that facilitate analysis of structural conditions that contextualize action. The conditional matrix is organized by concentric circles, or spirals in later versions, representing micro-meso-macro interaction with the core human phenomenon under study (Strauss & Corbin, 1990; Clarke, 2005). The conditions are arrayed around the core action from center to periphery and from local to global. These conditions in the matrices represent an abstract modeling of the elements in the social context that surround, frame, contribute, and condition the core action (Strauss & Corbin, 1990; Clarke, 2005). Straussian GT then would account for multiple levels of analysis modeled in the conditional matrix. Clarke (2005) suggested that in Strauss’s later work, he noted the

Axiology where it concerns values in inquiry and the positionality of the researcher (Creswell, 2007) is, again, outside of right conduct in research, given little attention in the Straussian orientation of GT. Straussian GT moves to a more post-positivist/pre-constructionist position advancing the challenge to the dominance of scientism. The orientation also represents a move toward facts and values interaction. While the researcher still maintains a more privileged position under this framework, the interpretive approach to an agentic knowing subject/participant softens this position. Yet there remains a noticeable lack of attention to the imposition of researcher bias and reflexivity.

**Rigor in Classical Grounded Theory.** Glaser & Strauss (1967) were among the first to identify the need for applicable criteria to judge the rigor and credibility of qualitative research. Specific criteria to account for the trustworthiness of grounded theory are outlined in the classical works of Glaser & Strauss (1967) and Glaser (1978), and have since been much extended, re-articulated, and contested as a framework for evaluation of qualitative inquiry more generally (Lincoln & Guba, 1985; Eisner, 1991; Lather, 1986a, 1986b, 1991, 1993, 2001; Wolcott, 1994; Lincoln, 1995; Patton, 2002; Richardson & St. Pierre, 2005; Jones, Torres, & Arminio, 2006; Creswell, 2007). These perspectives on validation and evaluation have been somewhat parallel and concomitant to paradigmatic shifts.
Lincoln and Guba’s (1985) foundational criteria include credibility using the
techniques of prolonged engagement, persistent observation, triangulation, peer
debriefing, negative case analysis, and member checks, as well as the criteria of
transferability, dependability, and confirmability. Added to these criteria by others are
evidentiary adequacy (Erickson, 1986; Ragin, Nagel, & White, 2004), comparability,
and reflexivity (Saumure & Given, 2008). Most recently, criteria such as consistency
of design and methodology (Arminio & Hultgren, 2002), catalytic authenticity
(Lather, 1991), and Lather’s (1993) four frames of validation have been offered.
These re-interpretations of standards of validation reflect accountability for
postmodern concerns over issues of representation, truth, authority, power, politics,
and complexity. Also consistent with these sensibilities, the older term of
trustworthiness is more recently shifting to the term, goodness, to indicate that quality
of qualitative inquiry (Arminio & Hultgren, 2002).

Jones, Torres, and Arminio (2006) suggested that general criteria for judging
the worthiness of research should be used; however, to that should be added additional
specific criteria to address the specific epistemological views and methodologic
approaches. This is the approach taken in Glaser and Strauss’s classical iterations of
grounded theory. They offered general criteria in an attempt to parallel the rigor of
quantitative research and then proposed specific criteria for evaluating the credibility
of a grounded theory study and the theory generated from such work.

The general criteria of trustworthiness suggested by Glaser & Strauss (1967)
are established by accounting for credibility and plausibility in the research process.
They outlined systematic coding procedures and the importance of providing evidence of interpretations from the data. Similar to the concept of prolonged engagement they asserted the need for study of a range and number of events/interviews. Consistent with the general criterion of dependability and confirmability, Glaser and Strauss (1967) suggested the provision of a trail to link concepts to theory. On the criterion of plausibility, the authors suggested that there should be a fit to the substantive area of focus and that the theory should be generated and substantiated through multiple comparison groups.

More specific criteria have been articulated to judge the adequacy of the theory generated from a grounded theory study. Glaser and Strauss (1967) and Glaser (1978) asserted that a substantive theory should be judged on the criteria of fit, work, relevance, and modifiability. These rather self explanatory concepts are the more well known criteria from classical grounded theory. In the move to second generation constructivist grounded theory, these criteria have been re-articulated under Charmaz (2006) to: credibility, originality, resonance, and usefulness. Criteria such as Lather’s (1993) four frames of validation will likely be applied to the re-formulation of grounded theory to situational analysis under Clarke (2005).

**Benefits and Limitations of Classical Grounded Theory.** The discussion of benefits of classical grounded theory must be predicated on the consideration of the historical context from which it emerged. Grounded theory methodology offers systematic processes and procedures for data collection and codified data analysis methods that are both visible and comprehensible (Bryant & Charmaz 2007). For this,
grounded theory has been credited with countering the increasing hegemony of quantitative methods and for legitimating qualitative modes of inquiry (Charmaz & Bryant, 2008). Glaser and Strauss (1965, 1967) also argued that the grand theories of the classic scholars failed to explain social phenomena and that quantitative research had failed to generate theory. Thus, they proposed a flexible yet systematic, inductive methodology for generating substantive and formal theory grounded in data to enable prediction and explanation of basic social processes and to be useful in theoretical advancement and in practical application (Bryant & Charmaz, 2007).

More recently, grounded theory is credited for its flexibility, applicability, and adaptability to diverse subject matter across disciplines thus, explaining its durability. Charmaz (2000) classified the benefits of grounded theory as a methodology for its ability to: provide strategy to guide the analytic process; to act as a self-correcting mechanism in the data collection process; to emphasize comparative methods; and to generate theory construction. Grounded theory is also recognized for producing theories that are reflective of practical situations, substantive theories, that then, support praxis based on theoretical knowledge (Corbin & Holt, 2005).

The most salient limitations or criticisms of grounded theory relate to the classical formulation that retains residuals of the positivist assumptions that it attempted to depart from. The iterations of grounded theory under Glaser & Strauss (1967) and Glaser (1978) are criticized for a naïve realism based on the assumption of an all knowing, expert researcher and the exclusive recourse to “the data.” The authors are judged for their assumption that reality is unitary and for the notion that
reality can be simply discovered and understood. Their inductive method has further been called naïve for failing to account for the complexity of phenomena of inquiry and for failing to account for the exceptions in observations. Their assumption that convergence on concepts from similar observations leads to certainty, valid conclusion, and generalizability implicates the limit of induction and has been termed Baconian (Bryant & Charmaz, 2007). Grounded theory under Glaser and Struass is further critiqued for a host of founded and perhaps unfounded accounts including epistemological naiveté (Emerson, 1983; Katz, 1983), slipshod attention to data collection (Loveland & Loveland, 1984), justification of small samples (Charmaz, 2006), and a presumption of incompatibility with macro questions (Brawny, 1991; Layder, 1998).

Clarke (2005) has detailed a number of related recalcitrancies of positivism in classical grounded theory. She and Charmaz (2006) have been critical of the lack of reflexivity in objectivist grounded theory. Lack of reflexivity is judged as inadequate for a denial of the researcher interaction in the situation under study, denial of the researcher’s a priori knowledge on the subject, and failure to address researcher positionality or issues of representation. Clarke has referred to this as “giving voice to the unheard from their own perspective” (2005, p. 11). Clarke (2005) and Charmaz (2006) also have viewed the classical formulation of grounded theory as an oversimplification for its focus on context-free basic social processes (Charmaz, 2006) and lack of attention to multiple social processes in interaction (Clarke, 2005). Clarke (2005) has also viewed this as an erasure of sub-processes, complexities, and
differences that constitute the situation. The handling of negative cases is another limitation that has been identified by Clarke (2005). Negative cases are handled as a normal versus deviant category under the classical grounded theory framework. This binary structure fails to account for range of difference (Clarke, 2005). Clarke has been critical of the forces toward methodologic purity that have largely been promulgated by Glaser (Clarke, 2005). On a final rather pivotal point is the criticism related to human agency. Glaser invested agency in neutral, objective method and in all that is data; whereas, Strauss bestowed agency on human researchers (Clarke, 2005) and on agentic subjects. The critique of the positivist recalcitrancies in classical grounded theory accounts for the second generation of grounded theory that advances constructionist and post-structural sensibilities on GT methodology and analytics.

**Second Generation Grounded Theory**

The second generation of grounded theory has been championed primarily by Charmaz (2006) and Clarke (2005) in their attempt to move grounded theory further away from its positivist position. They have moved grounded theory into a contextual constructionist position under Charmaz (2006) and a hybrid of situated constructionist and post structural positioning under Clarke (2005). A brief consideration of constructionism is given here as foundation for consideration of second generation grounded theory.
**Constructionism.** Constructionism, first articulated by Berger and Luckmann (1966), is now considered a paradigm as well as both an ontology and epistemology (Jones et al., 2006). [Note: the terms constructionism and constructivism are often used interchangeably in the literature; although, a distinction between the terms is also made (Gergen & Gergen, 2008). The terms will be used here interchangeably in accordance with their use in the references cited.] Constructionism represents a sociology of knowledge where knowledge is viewed as shaped by social processes. Contrary to extreme interpretations, constructionism is not a challenge to the physical universe (Best, 2008). Therefore, the understanding of social processes is the aim of inquiry. Constructivism is oriented to the production of reconstructed understandings of social phenomena (Denzin & Lincoln, 2005). Constructivism’s emphasis on the socially constructed nature of reality distinguishes its study of social human interactions from the study of other natural phenomena (Crotty, 1998; Patton, 2002; Glesne, 2006; Jones et al., 2006). Thus, the product of research from the constructivist paradigm is the generation of patterns of meaning (Creswell, 2007) that are both relative and impressionistic (Charmaz, 2000) and are the representations of reality as being multiple and subjective. Further, constructivism connects action to praxis and encourages multivocality (Denzin & Lincoln, 2005).

The ontologic perspective is that meaning is created through social interaction. The constructivist assumption stands opposed to the view that reality is objective, external, and independent from the individual (Best, 2008; Crotty, 1998; Patton, 2002; Glesne, 2006; Jones et al., 2006). Social constructivism is understood as relativist in
that constructivism acknowledges that different people come from different perspectives (Crotty, 1998). Thus, people have different ways of knowing, different ways of creating meaning, and separate realities (Denzin & Lincoln, 2005). Constructionism also holds that humans construct their own perceptions of the world and assign categories and meanings to the empirical world in context (Crotty, 1998; Patton, 2002; Best, 2008); whereby, reality is then multiple. This is a pivotal change from the positivist position on reality as extant, unitary, and out there to be discovered.

Constructivism maintains a relativist and transactional epistemology (Denzin & Lincoln, 2005; Jones et al., 2006). Under constructivism, social realities are understood through interpretation, translation, and representation. The relativist stance is taken from two primary perspectives. Normative, ethical, and moral relativism holds that, what one accepts as morally correct or incorrect varies within and between societies, and that there are no principles that are accepted by all people within or across particular societies (Smith, 2008, p. 750). Social reality is then “context dependent” (Smith, 2008, p. 750). Relativism stands in contradiction to the positivist assumptions of universal truth. Second, cognitive or epistemological relativism asserts that there are no universal truths existent outside of the use of language. “All that can be said about the world is that there are different ways of interpreting it-interpretations that are…relative to time and place” (Smith, 2008, p. 750). Those that refute relativism are critical on the point that considers relativism as logically self-contradictory and self-refuting (Smith, 2008). Yet, recent trends in
constructionist work are concerned with context and have advanced the term to contextual constructionism (Best, 2008).

On human interaction, constructivism also holds assumptions dealing with human agency and large socially structured interactions. The constructivist view confers agency to humans by the assumption that people make and account for their choices based upon their understanding of their alternatives. Furthermore, human perceptions of alternatives and accounting of choices made, constrain other actions (Holstein & Gubrium, 2008). On the larger social level, Smith (2008) argued that social processes also occur at larger social levels such that social processes crystallize and decrystallize in cycles accounting for such social phenomenon as gender, race, and now might be added, politics and power. These ontological and epistemological positions are, in part, the foundation of the constructivist and situative moves on second generation grounded theory.

**Charmazian Grounded Theory.** Charmaz (2000) has drawn on these and other constructivist assumptions in articulating her contextual constructivist move on grounded theory. Based on Schwandt (1994), Charmaz has considered that what is taken as real or objective and true is based upon individual perspective (Charmaz, 2000). With Clarke (2005) Charmaz has asserted that a real world exists but that the world perceived is never separate from individuals’ multiple perspectives and may differ from others’ and the researcher’s perspectives. Leaning also on pragmatist and interactionist assumptions from Thomas and Thomas (1928/1970), Charmaz has agreed that humans define their situations as real; and, as such, situations are real in
consequence. Reflecting a more contextual stance, Charmaz and Bryant (2008) have assumed that both the studied world and the research process are socially constructed through action and interaction that is historically and socially conditioned and constrained. Therefore, the aim of inquiry under Charmzian (2000, 2006, 2009) grounded theory is to understand what participants define as real, what assumptions underlie such reality, and where various perspectives on reality lead participants into action. This ontology is summed in the notion that the world is made real in the minds of individuals through the words and actions of themselves and others (Charmaz, 2000, 2006, 2009) predicated on social action that is embedded in the historical and social surround.

Charmaz (2006) has asserted that neither data nor theories are discovered and has advanced that researchers are part of the studied world. The assumption here is that knowledge is produced through “grappling with empirical problems” (Charmaz, 2009, p. 130); therefore, knowledge rests on social constructions produced under pre-existent, structural conditions, within emergent situations, historical conditions, and geographical locations and is influenced by researcher’s perspectives, interaction, privilege, and position (Charmaz, 2009, p. 130). Charmaz also has advanced that researchers construct grounded theories on reality through involvement, interactions, perspectives, actions, and research practices in that social world. Substantive theory is then conditioned by all contained in the context of its production. The researcher is not neutral and is viewed as playing an active role in the research process through a dialogic process with the participant and through interaction with the data through
analysis (Charmaz & Bryant, 2008). Charmazian (2006) GT, then, renders an interpretive stance of the studied world and a contextualized, theoretical construction of that reality. Charmazian grounded theory would view the research process as co-constructed and value-laden therefore encouraging a deeply reflexive stance.

Charmazian (2006, 2009) grounded theory methodology emphasizes flexible guidelines over methodological rules. Her version of grounded theory (Charmaz, 2006; 2009) maintains the strengths of methodological processes including an inductive thrust, iterative and simultaneous data collection and analysis, constant comparative analysis, open, selective, and theoretical coding, theoretical sampling, and grounded theorization. However, Charmazian constructivist grounded theory adapts the method to accommodate evolving postmodern ontologic and epistemologic underpinnings. Charmaz (2005) has retained the central focus of action, process, and meaning but has espoused particular attention to reflexivity around the social construction of research acts and researcher’s participation/positionality regarding data collection and analysis. To this end, Charmaz has also acknowledged the researcher’s sensitization and disciplinary perspectives as a point of departure and level of analysis rather than the purely inductive process put forth in Glaserian and Straussian forms of GT. A Charmazian (2005) perspective would also seek much deeper contextualization around the phenomena of concern and theoretical understanding over discovery and generalizations.

While Charmaz has espoused a rather hybrid synthesis of Glaserian and Straussian iterations on methodologic processes, there exist some points of departure
and a general leaning toward Glaserian analytics. Charmaz has preferred active coding in gerund form to allow the researcher to start with the subjective action and, through comparative analysis and progressive theoretical sampling, to grasp the meaning and assumptions that lie behind the concept of study (Charmaz, 2000, 2009). Charmaz (2000, 2009; Clarke, 2005) has been critical of Struassian axial coding and the use of “complex architecture” (Charmaz, 2000, p. 525) including Strauss and Corbin’s (1990) conditional matrices, Glaserian (1978) processual diagrams, or Clarke’s (2005) situational maps as analytics. It has been her view that use of such architecture imports an overlay on the data and in the Glaserian (1978) sense is a type of forcing analytic.

**Clarkesian Grounded Theory.** Clarke (2005) has advanced the recent turn of grounded theory toward constructivist/interpretive assumptions with a movement further toward more a fully relativist, perspectival, and situated understanding. Clarke’s (2005) salient ontologic assumption has been that realities are highly situated and produced within complex situations of actions and positionalities. A grounded theory approach under Clarke (2005) extending Strauss (1987) would seek to move beyond the action-basic social process as the unit of analysis to instead a “mapping” of the wider field of action from a situation-centered, social worlds/arenas framework. Clarke (2005) has asserted a deep commitment to “situating interpretation” and an accounting for social realities in all of their heterogeneity, complexity, multiplicity, tenuousness, instability, and contradiction.
Clarke’s (2005) complex view of phenomena has reflected a constitutive nature of reality regarding the elements that constitute actions and interactions of the situation. Contrary to contextual constructivist notions, Clarke has asserted that there is “no such thing as context” (2005, p. 71). In her view, the conditions bearing on a situation do not surround the situation. Instead, “[t]he conditions of the situation are in the situation” (Clarke, 2005, p. 71). This is a view that asserts that the elements/conditions that bear on a situation are constitutive of and affect all that is within situation. Clarke has drawn deeply on Foucault maintaining that reality must be understood in terms of that which conditions the possibilities of action and constitutes the “conditions of possibility” (Foucault, 1975) where “people,… things, humans,…nonhumans, fields of practice, discourses, disciplinary… regimes/formations, symbols, controversies, organizations, and institutions, each and all may be present and mutually consequential” (Clarke, 2005, p. 72).

Rooted in the ontologic politics of Gramsci (1971), Foucault (1972, 1973, 1980) and Haraway (1991), Clarke (2005) has viewed all knowledge and interpretations as partial, produced, and as situated within historical, geographical positions, and contexts. Situational analysis, then, would seek to capture and map the meso/macro field of action with particular attention to all elements, human and nonhuman, animate and inanimate, that constitute the reality of the situation (Clarke, 2005).

Clarke (2005) has been critical of traditional grounded theory for oversimplification of social processes and has sought to extend the Charmazian
postmodern framing of grounded theory to account for this complexity. Her view de-
centers human agency and takes specific account of nonhuman elements accounting 
for actors/actants, discourses, organizations, and institutions of the situation. Clarke’s 
(2005) conception builds a more meso/macro unit of data collection and analysis into 
the basic grounded theory methodology with situational analysis. For this pursuit, 
situational analysis supplements traditional grounded theory with three primary 
cartographic approaches which Clarke has aimed at both methodologic and analytic 
processes:

1. Situational mapping to lay out human, nonhuman, discursive, and other 
elements and relations.

2. Social worlds/arenas mapping to lay out collective actors, nonhuman 
elements, arenas of commitment, and discourse.

3. Positional mapping to lay out the positions taken and not taken, and axes of 
difference, concern, and controversy (Clarke, 2005).

Furthermore, Clarke (2005) has encouraged supplemental analysis of narrative, visual, 
and historical discourses. A grounded theory methodology under Clarke (2005) would 
require that the situation be the ultimate unit of analysis and that a 
relativist/perspectival understanding of the complexity, relations, and constitution of 
elements be the aim.

Methodologically, for Clarke, “awaiting emergence” is not enough (2005, p. 
75). Clarke has espoused the use of what she has termed, an ‘a priori’ approach to 
method. Clarke has drawn on Lather’s (2001) call for “concrete efforts to both
produce different knowledge and produce knowledge differently” (p. 201). To that end, Clarke (2005) has asserted that in methodologic processes, a conscious effort be placed on collecting data “that can explicitly address the salience or lack of salience of any of these issues for the situation at hand.” (p. 75). This, then, requires of the researcher a departure from traditional emergent designs. Clarke, drawing on Atkinson and Coffey (1997, 2003) similarly has advocated that a design, from the outset, give structure to “explicitly gather data about theoretically and substantively underdeveloped areas that may lie in [the] situation of inquiry” (Clarke, 2005, p. 76). Clarke (2005) in addition to acknowledging the researcher’s a priori disciplinary perspective as being sensitizing, further has suggested, as she has termed, the radical use of the researcher’s own experiences as an instrument of inquiry. This methodologic approach, then, imposes on the inherent inductive logic of grounded theory with a rather structurally architected approach to both data collection and analysis. Clarke (2005) has directed the researcher to use this situative and architected approach as a sensitizing framework on a fundamentally inductive process in her iteration of grounded theory.

Overlaps and Tensions in Second Generation Grounded Theory. One is reminded here of Kuhn’s (1962) classic views on intellection, scientific advancement, and paradigmatic shift - one such perspective being that in the developmental transitions of intellection, there are circumstances in which revolutionary forms/paradigmatic positions “may coexist peacefully in later periods” (Kuhn, 1962, p. xi). Thus, revolutionary, methodological forms, while rooted in a primary
paradigmatic framework, coexist with fluidity across boundaries and are, thereby, characterized by intersections and disruptions. The intersections and disruptions between objectivist and constructivist grounded theory have been considered heretofore. Yet, grounded theory in its more recent constructivist forms under Charmaz (2006) and Clarke (2005) coexist within the postmodern, constructivist turn as variant developmental forms born of a similar move toward a sensibility for complexity, multiplicity, fluidity, partiality, positionality, instability, contradiction, and fragmentation. The intersections and disruptions between Charmaz (2006) and Clarke (2005) are taken up here.

Both Charmaz (2006) and Clarke (2005) have espoused a constructivist epistemology with Clarke’s (2006) variant of grounded theory having taken a more fully relative, situated, and perspectival position. The social, procedural, and processual phenomena are also intersecting areas of concern under both iterations. Most characteristically are the inductive theoretical thrust and the adherence to the classic, systematic analytic of grounded theory with regard to simultaneous data collection and analysis, coding procedures, constant comparative analysis, and theoretical sampling as distinct intersections between these methodological forms. Arising out of the mutually held constructivist positions, Charmaz (2006) and Clarke (2005) both have asserted the importance of reflexivity and researcher positioning in the research process. Both have acknowledged the researchers grounding in disciplinary knowledge and have recognized the positioning of *a priori* knowledge as sensitizing concepts.
Yet, variant methodological forms often develop more significantly along the lines of disruption and boundary crossings. The iterations of Charmaz (2000, 2006, 2009) and Clarke (2005) on grounded theory mutually hold constructivist positions. Yet Charmaz holds a more contextual constructivist position while Clarke’s constructivism is deeply embedded with post structural sensitivities and could be called constitutive constructivist or a post structural positioning. This difference in perspective between Charmaz and Clarke, then, affects their views on the agentic subject and issues of representation and consequently then on their level of analysis, analytic approach, and researcher positioning in their methodologic approach.

Charmazian (2000, 2006, 2009) constructivism is deeply committed to understanding the contextual elements that condition meaning and action. This stance confers agency on the subject as actor and as a “knowing” informant. A Charmazian approach would center the agentic subject and would view meaning and actions as affected by elements in the context. This is a view of a human centered domain and the context that surrounds the subject and influences consequences. Under Charmaz’s framing, human and non human elements would be acknowledged as contextual features having influence on meaning and action of participants and as shaping and nature of inquiry (Bryant & Charmaz, 2007).

Charmaz’s perspective on the agentic subject echoes classical theories of agency in sociology. Classical theories maintain the assumption that humans have agency and espouse a dualist perspective on the relationship of agency and structure (Fuchs, 2001, p. 27). Theories on agency are traceable to Weber’s social action theory
Expressed in different vocabulary, the Weberian conception of agency is most simply that of the ability to accomplish meaningful action (Campbell, 2009). The concepts of subject-centering and context surrounding/influencing are evident in Weber’s famous words implying that agency is the, “probability that one actor within a social relationship will be in a position to carry out his own will despite resistance” (1964, p.52). Weber’s conceptualization led to concern for the relationship between cultural context, social structures, and agency - the agency-structure debates that have since remained the predominant concept (Campbell, 2009) going forth most notably evident in the work on structural-functionalist theories such as Parsons and Smelser (1955) as well as in conflict theories exemplified in the work of Bourdieu (1977, 1986).

In opposition to this perspective, Clarke (2005) has denied the operation of contextual features as surrounding and conditioning meaning and action. In her words, “[t]he conditions of the situation are in the situation. There is no such thing as context” (Clarke, 2005, p. 71). This stance de-centers the human subject going beyond “the knowing subject” to appreciate the elements in the situation as constitutive of and not contextual around. A Clarkesian (2005) approach would seek a re-representation that accounts for the salient elements in the situation that are at once within the situation and constitutive of it. Such an approach would also view human and nonhuman elements as co-constitutive of a situation and including actors, actants, structures, and discourses. Clarke (2005) has gone beyond Strauss, and the assumptions supporting the conditional matrix, leaning more heavily on Foucault and
post-structural sensibilities to inform a rather constitutive constructivism. Clarke specifically has cited Foucault’s notion of the conditions of possibility and de-centering of human agency in the following passage.

I am interested, in fact, in the way in which the subject constitutes himself in an active fashion, by the practices of self, these practices are nevertheless not something that the individual invents by himself. They are patterns that he finds in his culture and which are proposed, suggested and imposed on him by his culture, his society and his social group (Foucault, 1988, p. 11).

Thus in Clarke’s view studying action is not enough and more attention should be paid to objects/elements in situation (Clarke, 2005).

Clarke (2005) has been deeply concerned with the agency, then, of nonhuman elements, discourses, and materialities and making them visible at the outset by accounting for them in the methodological approach. This emphasis on issues of representation, de-centering the all knowing and agentic subject, and foregrounding nonhuman, agentic elements, differences, fragmentations, partialities, silences, and social worlds/arenas as constitutive of the situation is a more post-structural (Lather, 1991, 1992, 2004; Crotty, 1998; Green & Stinson, 1999; Jones et al., 2006; Miller, Whalley, & Stronach, 2005; Fox, 2008; Faucett, 2008) positioning that aligns more now with contemporary Actor-Network Theory (Latour, 2004; Law, 2004). This post-structurally informed and more constitutive constructionism is the salient disruption between the Charmazian and Clarkesian approaches to grounded theory accounting for their methodologic differences aforementioned.
<table>
<thead>
<tr>
<th>Paradigm</th>
<th>Positivist-Post</th>
<th>Post Positivist</th>
<th>Constructivist</th>
<th>Post-Structural</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intellection</strong></td>
<td>Classical</td>
<td>Second</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grounded Theory</td>
<td>Generation</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Glaserian</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ontology</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extant reality</td>
<td>Interactionally created reality</td>
<td>Contextual &amp; socially constructed reality</td>
<td>Fluid, fragmented, highly situated reality</td>
<td></td>
</tr>
<tr>
<td>Emergent Truth</td>
<td>Symbolically represented truth</td>
<td>Truth as multiple, partial, situated &amp; complex</td>
<td>Diverse, complex, multiple &amp; contradictory truth</td>
<td></td>
</tr>
<tr>
<td>Determinate unitary causation</td>
<td>Embedded conditional causation</td>
<td>Relative, indeterminate causation</td>
<td>Constitutive causation</td>
<td></td>
</tr>
<tr>
<td><strong>Purpose / aim</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discovery, abstraction, explanation &amp; prediction</td>
<td>Discovery, interpretation, conceptual representation</td>
<td>Interpretation</td>
<td>Situated interpretation</td>
<td></td>
</tr>
<tr>
<td>Substantive &amp; formal theory generation</td>
<td>Substantive theory &amp; provisional verification</td>
<td>Theory Construction</td>
<td>Thick analysis of elements &amp; intersections</td>
<td></td>
</tr>
<tr>
<td>Universal truth &amp; generalizability</td>
<td>Problem solving, application &amp; control</td>
<td>Meaning related to contextual action</td>
<td>Provisional, situated, theory construction</td>
<td></td>
</tr>
<tr>
<td><strong>Epistemology</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Objectivist, naïve realism</td>
<td>Objectivist, pre-constructivist</td>
<td>Constructivist / interpretivist / relativist</td>
<td>Relativist / perspectival interpretivist</td>
<td></td>
</tr>
<tr>
<td>Knowing subject</td>
<td>Agentic subject: Conditions, meanings &amp; actions</td>
<td>Agentic Subject / Participant / Constructor</td>
<td>De-centered subject; actor/actant producers</td>
<td></td>
</tr>
<tr>
<td>Knowing researcher / author</td>
<td>Reconstructor researcher / author</td>
<td>Co-constructor researcher / author</td>
<td>Positioned researcher producer</td>
<td></td>
</tr>
<tr>
<td><strong>Axiology</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neutrality / Objectivity</td>
<td>Neutrality / Objectivity</td>
<td>Value Laden</td>
<td>Diverse meanings, voices &amp; intensities sought</td>
<td></td>
</tr>
<tr>
<td>Facts &amp; values separated</td>
<td>Facts and interactions sought</td>
<td>Co-constructed meaning &amp; reciprocity sought</td>
<td>Value Imposed / subjective</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Grounded Theory: Evolution of Intellection
Table 2 continued

<table>
<thead>
<tr>
<th>Paradigm</th>
<th>Positivist</th>
<th>Post-Positivist</th>
<th>Constructivist</th>
<th>Post-Structural</th>
</tr>
</thead>
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<tr>
<td>Intellection</td>
<td>Classical Grounded Theory</td>
<td>Second Generation Grounded Theory</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Glaserian</td>
<td>Straussian</td>
<td>Charmzian</td>
<td>Clarkesian</td>
</tr>
<tr>
<td>Methodology / Methods</td>
<td>Inductive logic</td>
<td>Inductive &amp; pragmatist logic</td>
<td>Inductive &amp; abductive logic</td>
<td>Inductive logic</td>
</tr>
<tr>
<td></td>
<td>Qualitative (possibly quantitative)</td>
<td>Qualitative</td>
<td>Qualitative</td>
<td>Qualitative</td>
</tr>
<tr>
<td></td>
<td>Simultaneous data collection &amp; analysis</td>
<td>Simultaneous data collection &amp; analysis</td>
<td>Simultaneous data collection &amp; analysis</td>
<td>Simultaneous data collection &amp; analysis</td>
</tr>
<tr>
<td></td>
<td>Iterative constant comparative analysis &amp; theoretical sampling</td>
<td>Iterative constant comparative analysis &amp; theoretical sampling</td>
<td>Iterative constant comparative analysis &amp; theoretical sampling</td>
<td>Iterative constant comparative analysis &amp; theoretical sampling</td>
</tr>
<tr>
<td>Memoing</td>
<td>Memoing</td>
<td>Memoing</td>
<td>Memoing</td>
<td>Memoing</td>
</tr>
<tr>
<td>Analytics</td>
<td>Emergent concept indicator</td>
<td>Paradigm Model</td>
<td>Emergent conceptual analysis</td>
<td>Situational Analysis</td>
</tr>
<tr>
<td></td>
<td>Open, selective &amp; theoretical coding</td>
<td>Open, Axial &amp; Selective coding</td>
<td>Initial, focused &amp; theoretical coding</td>
<td>Traditional coding</td>
</tr>
<tr>
<td></td>
<td>Eighteen coding families</td>
<td>Conditional Matrix</td>
<td>Layered Analysis</td>
<td>Network Cartography</td>
</tr>
<tr>
<td>Level of Analysis</td>
<td>Basic social process</td>
<td>Processual – Actional - Interactional</td>
<td>Processual – Contextual</td>
<td>Ecological – social world – arenas</td>
</tr>
<tr>
<td></td>
<td>Micro</td>
<td>Micro – meso - macro</td>
<td>Micro - meso</td>
<td>Meso-macro / co-constructions / co-constitutions</td>
</tr>
</tbody>
</table>

(Adapted from Glaser & Strauss, 1967; Glaser, 1978; Strauss & Corbin, 1990; Charmaz, 2006; Charmaz & Bryant, 2008; Charmaz, 2009; Clarke, 2005)
Application of Grounded Theory in this Study

The purpose of this study was to explore the nature and determinants of presence in human patient simulation among baccalaureate nursing students. The aim of the study, was to delineate the dynamics and dimensions of presence in this mixed reality form of simulation and to examine potential determinants of presence as they may explain the state of being present achieved by students participating in HF-HPS. This inquiry was directed at the development of a conceptual model that might build on existing models and might also support pedagogy for the use of human patient simulation in nursing education. The goal of this study was also to guide future research on HF-HPS concerning the promotion of positive learning outcomes and ultimately learning transfer to the live health care situation such as could potentially lead to improved safety and quality of patient care.

Ontologic, Epistemologic, and Theoretical Assumptions. The state of being present in simulation and the interpretive understanding of the presence experienced by nursing students learning with HF-HPS were viewed as a perspectival and situated phenomenon produced in the context of interaction in the artificially constructed situation of HF-HPS. This is consistent with Clarke’s (2005) salient ontologic assumption that realities are situated and produced within complex situations of actions and positionalities of “people,... things, humans,…nonhumans, fields of practice, discourses, disciplinary… regimes/formations, symbols, controversies, organizations,
and institutions, each and all may be present and mutually [co-constitutive] and consequential “ (Clarke, 2005, p. 72).

Aligned also with the theoretical underpinnings of symbolic interactionism (SI) this grounded theory inquiry was sensitized by a symbolic interactionist (Mead, 1934; Blumer, 1969) framing concerning presence as the primary phenomenon of study. Blumer’s (1969) articulation of SI is rooted in three foundational assumptions. (1) Humans act toward objects and beings based on the meaning that they ascribe to those things. (2) The meaning that humans attribute to objects and beings arises out of or is mediated by social interactions. (3) The meanings that people ascribe are derived through an interpretive process employed by persons in specific situations of which human behavior may be a product. In Blumer’s interpretation, then, humans are social actors that interpret the indications of objects and being. By way of engaging in interaction, people use ascribed meaning as the basis for directing action. SI assumes a centrality of self, symbols, mind, interaction, and action (Charon, 2010).

Snow’s (2001) articulation of SI expands the connection of assumptions in SI between interactive determination, symbolization, emergence, and human agency. Such connections focus inquiry then on what is happening in a social context allowing for the identification of social, emotional, or cognitive changes as they emerge and direct the grounded theory study to assume that meaning is made through interaction in context where meaning and social context influence the way that human agency is enacted (Snow, 2001; Munhall, 2007).
Charmaz (2009) and Clarke (2005) have asserted the power of SI and grounded theory as a “theory-methods package.” SI was acknowledged in this study as a starting point and sensitizing framework for the conceptualization of presence in HF-HPS as a multidimensional, social, and interactional phenomenon where participants’ interaction and engagement with a simulation may evoke an emergent and interpretive response to the meaning of a reality represented that would condition action in the simulation. SI also sensitized this inquiry to the potential of presence having a given nature of sensory, perceptual, cognitive, psychological, social and actional domains that may be mediated and contextualized by HF-HPS technology and other participant actors as the objects of interaction. The linkage of assumptions in SI also supported the questions initially engaged in this study around the forbearance of presence on clinical agency and on the reality perceived or the reality produced as a learning outcome. SI also oriented the inquiry to interpretive work and the resulting theory taken to be one of other possible interpretations (Charmaz, 2006).

Consistent with the epistemological perspectives of Charmaz (2006) and Clarke (2005), I considered myself to be a non-neutral participant playing an active role in the research process through a dialogic engagement with the participants and through interaction with the data derived of human and nonhuman elements in the situation (Charmaz & Bryant, 2008). A consitutive and co-constructivist stance was assumed where an interpretive, situated theoretical construction of presence of nursing students involved in human patient simulation would be rendered as emergent through the process of inquiry. For this inquiry I also recognized myself as an instrument in
the more Clarkesian (2005) sense where experiences, disciplinary perspectives, and theoretical assumptions were recognized as potential elements for theoretical sampling in this grounded theory methodology. Consistent, then, with Charmazian (2006) and Clarkesian (2005) grounded theory, a reflexive process was undertaken in an effort to balance and to remain accountable to the potential of researcher imposition on the data. Also consistent with a Glaserian (1978) analytic, I awaited emergence from the data to justify the employment of disciplinary or theoretical assumptions for elements of theoretical sampling and interpretations.

A second generation orientation to grounded theory most aligned with Charmaz (2006) was adopted for this study. The Charmazian (2006) approach assumed a contextual constructionist position where knowledge was assumed to be shaped by social processes (Best, 2008) and the aim of the inquiry was the understanding and interpretation of presence as a social process. A constructionist grounded theory holds that meaning is created through social interaction and that humans construct their own perceptions of the world and assign categories and meanings to the empirical world in context (Best, 2008; Glesne, 2006; Jones et al., 2006; Patton, 2002; Crotty, 1998). On human interaction, a constructionist grounded theory would also confer agency to humans by the assumption that people make and account for their choices based upon their own understanding and that may also constrain other actions (Holstein & Gubrium, 2008). Therefore, the aim of the inquiry under Charmazian (2000, 2006, 2009) grounded theory was to understand what participants define as the nature of presence, what assumptions underlie such reality,
and how or where various perspectives and determinants on the state of being present in simulation lead participants into action. This ontology is summed in the notion that the world is made real in the minds of individuals through the worlds and actions of themselves and others (Charmaz, 2000, 2006, 2009) predicing on social action that is embedded in the social surround. Charmazian (2006) GT, then, renders an interpretive stance of the studied world and a contextualized, theoretical construction of that reality. Charmazian GT would view the research process as co-constructed and value-laden, therefore, encouraging a reflexive researcher stance.

Under this Charmazian (2005, 2006, 2009) GT methodology, this study emphasized flexible guidelines over stringent, methodological rules. The methodological process maintained an inductive thrust, iterative and simultaneous data collection and comparative analysis, open, selective, and theoretical coding, theoretical sampling, and grounded theorization while seeking contextualization and espousing particular attention to reflexivity around the social construction of research acts and researcher’s participation/positionality throughout data collection and analysis. This approach espoused a rather hybridization of Charmazian (2005, 2006, 2009) and Glazerian iterations on methodologic processes with a general leaning toward the Glaserian (1978) analytic. In his approach, a process of active coding in gerund form was used to start with the subjective action and through comparative analysis and progressive theoretical sampling, to grasp the meaning of the participants that lie behind the concept of study (Charmaz, 2000, 2009). Architected analytics such as axial coding, conditional matrices (Strauss & Corbin, 1990), or situational
mapping (Clarke, 2005) were purposefully avoided to guard against imposition of concepts or forced linkages on the data and ultimate conceptual model of presence in HF-HPS.

**Data Collection Method.** Based on the disciplinary and theoretical perspectives acknowledged earlier, sources of potential data collection were identified at the outset of this study. Pre-licensure, traditional, baccalaureate nursing students participating in HF-HPS were considered to be the primary sample. The following potential sources categorized according to Clarke’s (2005) situational framework were also identified initially: course faculty, experienced nurses, and hospital nurse educators (individual human actors); human patient simulator mannequins, simulation scenario, and related technologies/props in the learning environment (nonhuman elements/actants); simulation lab faculty and staff, interdisciplinary team members (collective human elements/actors); academic or hospital administrators (discursive human actors); and discourse on simulation of professional organizations and literature (collective human elements, issues and debates). Potential sources of data collection were invoked if and when justified through an emergent process identified through constant comparative analysis and theoretical sampling processes (Glaser, 1978; Glaser & Strauss, 1967; Strauss & Corbin, 1990; Charmaz, 2006; Clarke, 2005).

The inquiry began with observation of the simulation episodes and interviews with the primary sample of traditional, baccalaureate, pre-licensure nursing students that participated in the simulation episodes. Data collection purposively spread out to
seek human and nonhuman elements that constituted the situation as they emerged as themes from the data. Based on the emergent themes and concepts, course faculty were interviewed next in the sequence. Through a continued process of theoretical sampling and constant comparative analysis, observations of simulations and interviews with experienced nurses and hospital nurse educators were conducted next in sequence followed by interviews with administrators of participating simulation labs and hospitals. At the conclusion of the earlier process of theoretical sampling, an iterative process of data collection was employed for further theoretical sampling in search of differing perspectives or negative cases. The iterative sampling was also performed for validation interviews (Morse, 2007) to seek verification and stabilization of the theoretical concepts. For this process, a return to data collection from a second primary sample of traditional pre-licensure nursing students and a secondary comparative sample of second degree pre-licensure, grad-entry nursing students was employed.

This emergent and comparative data collection process was consistent with Charmazian (2006) and Glaserian (1978) analytics. The process also addressed Clarke’s (2005) concern for achieving the complexity of a situation by addressing “the salience or lack of salience” of elements that might bear on the situation and, as such, would constitute presence and clinical agency experienced by nursing students participating in human patient simulation. Yet, the emphasis on awaiting emergence in the design for data collection and an emphasis on reflexivity aimed to assure the intended inductive thrust as well as Charmaz’s (2006) and Glaser’s (1978) concern for
avoidance of forcing analytics. The use of multiple sources of data also de-centered the voice of the primary participants from a position of all knowing informers (St. Pierre, 2008; Clarke, 2005; Britzman, 1995; Scheurich, 1995) and facilitated, as Milliken and Schreiber (2001) have recommended, a more consensual view on the reality of presence in HF-HPS.

Data was collected by semi-structured group and individual interviews (Kvale & Brinkmann, 2009; Creswell, 2007; Munhall, 2007; Patton, 2002; Fontana & Frey, 2000). Group interviews composed of 4-8 participants at a time were conducted with all simulation participants during the standard 20-30 minute debriefing sessions immediately following the simulation episodes. Individual one-to-one interviews were conducted within 30 minutes to 48 hours following the simulation encounter with all participants that agreed to an interview. Interviews with faculty and administrators occurred through the process of the emergent theoretical sampling sequence. Duration of the interviews was 30 – 60 minutes. The interviews were conducted in private, casual settings at the location of the simulations at either the universities or the hospitals. Interviews with three of the experienced staff nurses were conducted via telephone upon their request for the convenience of their schedule.

The initial interview questions were structured around concepts considered to be related to presence and clinical agency that were drawn from the literature and the researcher’s experience. The use of the semi-structured interview allowed the researcher to address constitutive salient and thematized (Kvale & Brinkmann, 2009) elements but also facilitated interviewees to explain their own thoughts and open
emergent issues or concepts. Semi-structured interviewing also allowed the interviewer to probe and explore concepts that emerged for theoretical sampling (Kvale & Brinkmann, 2009). The initial interview guide is presented in Appendix A. In keeping with a GT approach, throughout the study, the interview questions were narrowed, broadened or revised to focus around categories or concepts that emerged for theoretical insight (Charmaz, 2001). Interviews were digitally, audio recorded and transcribed verbatim following standard transcription conventions (Kvale & Brinkmann, 2009).

All simulations that the students and experienced nurses participated in were observed. The textual documentation concerning the scenario description, learning objectives, equipment/supplies/moulage/props, and mannequin state events/settings was also included in the data corpus. Each simulation session was considered an “encounter” for observation (Lofland, Snow, Anderson, & Lofland, 2006). Observations of the simulations were conducted through a one-way glass window when available and were recorded by digital audio/video recording. Two of the simulation observations of experienced staff nurses were conducted with the observer located off to the side in the simulation lab when a one-way glass window was not available. For all simulations, participants were aware that they were being observed.

The simulations were a standard academic course requirement that the students were involved in. In the case of the experienced nurses, the simulations were a required component of an educational and/or competency testing program. All simulations were 2 hour learning experiences comprised of a preparatory assignment,
lab orientation, preplanning session, 1-1.5 hour simulation scenario and a 20-30 minute debriefing session. The simulations were dynamic, scenario-based simulations concerning a declining patient health status (post mastectomy surgical hemorrhage, acute myocardial infarction, respiratory failure and septic or cardiogenic shock) and requiring either an urgent intervention (blood/fluid administration and intravenous medication administration) or emergency code resuscitation. All simulations utilized the METI® prehospital model human patient simulator. Descriptions of the simulation scenarios, state changes, care requirements, and factors of fidelity are presented in Appendix C.

An adapted process of descriptive, focused, and selective observation was used (Spradley, 1980). For focused and selective observations, a semi-structured observation framework was utilized for data recording to sensitize the researcher to relevant elements for observation in the scenario enactments, but again, to allow for emergent elements in the observation (Creswell, 2007; Patton, 2002; Munhall, 2007; Lofland et al., 2006). Categories of observation included sensory-perceptual, cognitive, psychological, actional/agentic, hierarchical, structural, processual, causation/consequential aspects, and meanings. The observation framework is presented in Appendix B. Jottings were recorded during the observation session and detailed field notes and video transcriptions were written within 24 hours following the simulation encounter. The practices of jottings and field notes were adapted from Emerson, Fretz, and Shaw (1995). Member checks were employed during simulation
debriefing sessions for validation of participants’ meanings and perceptions derived from the researcher’s observations.

**Sampling.** In grounded theory methodology, sampling is determined by the principles of theoretical sampling and theoretical saturation. Theoretical sampling refers to sampling of data to clarify, develop, dimensionalize, and/or refine emerging concepts/categories in the emergent theory. Sampling is continued among participants or sources, not by a predetermined quota, but instead until no further theoretical elements, concepts, categories or positions emerge (Clarke, 2005; Charmaz, 2006; Glaser, 1978; Glaser & Strauss, 1967). Sampling also needs to achieve representativeness (Stern, 2007) and must continue until not only the categories are densely developed, but also until the model or theory is complete (Morse, 2007).

A pre-determined sample size was avoided at the outset of the study. Consistent with a grounded theory study, an *a priori* specification of sample size would run contrary to a GT analytic (Morse, 1991, 2001; Sandelowski, 1995, 2001). However, for the purpose of study approval, a range of 25-50 total interviews was estimated. This sampling plan was consistent with current recommendations on sample sizes in grounded theory studies. Patton (2002) suggested that “there are no rules for specific sample sizes in qualitative inquiry” (p. 244). Sampling should instead be “based on the validity, meaningfulness and insights” (Patton, 2002, p. 245) generated from the data (Creswell, 2007). Stern (2007) suggested that between 20-30 individuals is an appropriate estimate for grounded theory studies. Moreover, Clarke
(2005) suggested that a sampling plan should be aimed at balancing perspectival elements, de-centering the primary subject from an agentic and all knowing position, and at opening up salient or less salient elements to analysis.

Multiple sites were used for sampling in this study. Samples were purposively drawn from the Ohio State University College of Nursing, The Ohio State University Medical Center, the OhioHealth Riverside Hospital and Capital University School of Natural Science, Nursing and Health. For the primary sample of traditional baccalaureate nursing students, observations of simulations were conducted at the Ohio State University College of Nursing and at the OhioHealth Riverside Hospital where nursing students of Capital University participate in simulation lab. Interview participants were recruited from among the participants in the simulations conducted at the sites. The sample of nursing faculty was drawn from the faculty that participated in the simulations. Similarly, observations of simulations were conducted at Ohio State University Medical Center and the samples of experienced nurses and nurse educators were drawn from the participants in the simulations. The sample of administrators was drawn from those associated with the simulation laboratories and nursing education or administration departments at the participating colleges and hospitals. Simulation observations and participants being drawn from multiple sites, roles, and sources encouraged a more meso level of analysis and aimed at accounting for differing perspectives while also de-centering the primary subjectivity.

The criterion for initial inclusion in the study was that interviewees were pre-licensure, traditional baccalaureate nursing student participants in one of the high
fidelity human patient simulation scenarios that was observed by the researcher. Subsequent criteria for comparative and theoretical sampling included that interviewees: (1) were faculty facilitators in one or more of the simulations observed, or (2) were course faculty associated with one or more of the simulations observed, or (3) were faculty that were operators and/or voices of the mannequin in any of the simulations observed, or (4) were administrators of the simulation labs at the sites utilized, or (5) were experienced nurses or nurse educators that participated in one of the simulations observed, or (6) were nurse educators / clinical specialists associated with the use of HF-HPS in the participating hospitals, or (7) were 2nd degree pre-licensure nursing students, or (8) were nursing administrators having supervisory and budgetary responsibility for the facilities related to simulation at the participating colleges or hospitals. The criteria for inclusion related to the selection of simulations observed were that the simulation utilized HF-HPS and that the simulation design included a dynamic, medical surgical scenario having a declining patient status. Static, instrumental or task oriented simulations were not included in the sample since immersive presence was not a purposeful learning objective in these simulations. The researcher observed all the available simulations that met the criteria and were scheduled at the participating sites during the study period spanning three academic terms. Sampling continued until saturation, representativeness, density, validation, and stabilization of concepts and linkages in the model were achieved.

In Table 3 is presented the sample description for this study. There were a total of 145 participants in the study overall. Of this total, participants were involved
in either the simulation observation and/or in the interview parts of the study. A total of 36 simulation encounters were observed. The simulation observation sample consisted of 16 simulations from the primary sample of traditional baccalaureate pre-licensure nursing students. These students were all upper division students at either the end of their junior year or the beginning of their senior year of their nursing curriculum. Twelve simulation encounters were from the comparative sample of experienced registered nurses and 8 simulation encounters were from the comparative sample of second degree pre-licensure nursing students. A total of 60 participants of the primary nursing student sample were observed in HF-HPS and participated in the group debriefing interviews. The comparative samples consisted of 30 registered nurses, 32 second degree nursing students and 20 faculty/nurse educators that were observed in HF-HPS and participated in group debriefing interviews. Of this total sample, a subtotal of 94 participated in in-depth individual interviews. The interview sample consisted of 50 traditional, baccalaureate, pre-licensure students from the primary sample, 20 second degree, pre-licensure students, 10 registered nurses, 11 faculty/nurse educators, 2 simulation lab directors, and 1 nursing administrator from the comparative and theoretical sampling. Demographic data for all participants is presented in Table 3.
<table>
<thead>
<tr>
<th>Participants</th>
<th>Sample size (n)</th>
<th>Age Range (years)</th>
<th>Gender</th>
<th>Race</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Nurses (Traditional Baccalaureate program)</td>
<td>60</td>
<td>20-25</td>
<td>Female 52 Male 8</td>
<td>White 52 Black 3 Asian 3 Hispanic 2</td>
</tr>
<tr>
<td>Student Nurses (2nd degree program)</td>
<td>32</td>
<td>24-36</td>
<td>Female 26 Male 6</td>
<td>White 26 Black 2 Asian 3 Hispanic 1</td>
</tr>
<tr>
<td>Registered Nurses</td>
<td>30</td>
<td>23-45</td>
<td>Female 26 Male 4</td>
<td>White 27 Black 2 Asian 0 Hispanic 1</td>
</tr>
<tr>
<td>Faculty / Nurse Educators</td>
<td>20</td>
<td>35-60</td>
<td>Female 20 Male 0</td>
<td>White 18 Black 2</td>
</tr>
<tr>
<td>Simulation Lab Directors</td>
<td>2</td>
<td>35-45</td>
<td>Female 2 Male 0</td>
<td>White 2</td>
</tr>
<tr>
<td>Nursing Administrators</td>
<td>1</td>
<td>50-60</td>
<td>Female 0 Male 1</td>
<td>White 1</td>
</tr>
<tr>
<td>Total</td>
<td>145</td>
<td>20-55</td>
<td>Female 126 Male 19</td>
<td>White 127 Black 8 Asian 6 Hispanic 4</td>
</tr>
</tbody>
</table>

Table 3. Demographic Characteristics of the Sample.

**Ethics and Protection of Human Subjects.** Protection of human subjects was assured in this study. Institutional review board (IRB) approval was attained at all sites of study including the Ohio State University, OhioHealth-Riverside Hospital and Capital University. In Appendix D are presented the IRB approval letters from each of the participating sites. After IRB approval was granted from all institutions, a visit was made to the educational course / experience offering of potential nursing students.
and experienced nurses for recruitment. The recruitment script is provided in Appendix E. Participants were provided an explanation of the study and were requested to participate. Potential participants were informed that their participation was voluntary and that there was no direct benefit or anticipated risks from participation in the study. Since nursing students and experienced nurse learners were considered captive groups, potential participants were informed that the study was not an academic or a work requirement and did not impact their academic or employment evaluation or standing. Similarly faculty, nurse educators, and nurse administrators were invited to participate by the researcher by email or by face-to-face invitation. These participants were also provided explanation of the study and assurance that participation was voluntary, without direct benefit, or anticipated risk. All participants signed an informed consent. The informed consent for each of the three participating institutions is provided in Appendix F.

All participants were informed that should they agree to be interviewed, in appreciation of their time and participation in the interview, remuneration for their time would be provided. The remuneration provided was a gift certificate of $10.00 to a coffee shop, restaurant, or retail shop. The gift certificates were of low monetary value to guard against the potential of undue influence. Participants were also informed that they could refuse participation at either the time of the recruitment or at any time during the study.

The interview included demographic information but was kept to a meaningful minimum and did not include personally identifying information. A unique identifier
was attached to the data collection forms for observation and interviews to link the participants to the observed simulation. The unique identifier was created by the researcher and was known only to the researcher. Records of both text and digital recordings were stored in locked file cabinets or on password protected computer files. All data was retained and will be destroyed at a later point in accordance with the policies of the IRBs that approved the study.

**Analysis.** Observations were transcribed and read in their entirety by the researcher. Interviews were transcribed by a professional transcription company. Following transcription, the researcher listened to the audio tapes of the interviews while reading the transcription for coding. Classic Glaserian (Glaser & Strauss, 1967; Glaser, 1978) coding was followed using an iterative process of open coding, followed by comparative analysis, theoretical sampling, selective coding and again comparative analysis followed by theoretical sampling and theoretical coding. As theoretical codes stabilized, the return to sampling again from the primary sample of nursing students and a second comparative sample from second degree nursing students was undertaken for validation.

Concepts and indicators were generated following a Glaserian (Glaser, 1978) analytic to understand the dimensions and determinants of presence in HF-HPS. As indicator themes merged into concepts from this level of analysis, the analysis moved to theoretical coding using the Six C’s of Glaser’s (1978) analytic as the basis for understanding the determinants of presence in HF-HPS. A preliminary model
emerged from this theoretical analysis. The final level of analysis was directed at condensing concepts and raising the level of abstraction in the model. Concepts and linkages in the model were, then, utilized in the last round of sampling as a component during the interviews for stabilization, refinement, verification, and validation.

Memoing was used throughout the analytic process to encourage theoretical sensitivity, raise the level of abstraction, and to generate interconnections between codes and categories. The researcher also engaged in a process of ongoing reflexivity during data collection and analysis through embedded journaling in order to examine the potential impact of researcher – participant interaction and researcher impact on the data.

Validity. A full discussion of issues of validity related to a grounded theory methodology in general has been undertaken in the classical grounded theory section within this chapter. This study aimed to assure all relevant measures for enhancing the quality of data and analysis that are given in that section. Measures to insure credibility included prolonged engagement, persistent observation, systematic coding procedures, trail of linkage from concept to theorization, member checks, triangulation (Lincoln & Guba, 1985; Glaser & Strauss, 1967), discrepant case and thick analysis (Erikson, 1986; Patton, 2002; Clarke, 2005).

To achieve prolonged engagement and persistent observation, I remained in the field for three academic terms. All simulations were personally observed and transcribed. All the interviews were conducted by myself. Interviews were in depth and lasted 30-60 minutes. Considering that a simulation learning experience has a
typical duration of 1.5 – 2 hours, the length of the interview period was significant in relation to the length of the experience that the interview addressed. The use of member checks further support the credibility of this study. Member checks were used within interviews, as well as between observations and interviews throughout all levels of the analysis.

Interviewing in this study was regarded as an active and non-neutral process producing co-constructed (Charmaz, 2001), negotiated (Clarke, 2005), and indeterminate (Scheurich, 1995) text. Strategies were undertaken to minimize the noted problematic of interviewer-respondent interactions (Fontana & Frey, 2000, 2005; Holstein & Gubrium, 2008; Spradley, 1980). Reflexive journaling was used to maintain a sensitization to the researcher imposition on the data and analysis. With due regard to Pillow’s (2003) deconstructive concern for the power and limitations of self-confessionals as any cure for questions of credibility in qualitative research, additional measures were undertaken. A responsive interview style (Rubin & Rubin, 2005) was used. For this, the style of conversation was adapted to increase the comfort level in regard to the personality of the participant and the researcher. Additionally, two sequencing strategies were employed. First a traveler approach (Kvale & Brinkmann, 2009) was used where the researcher asked the interviewee to simply “describe their simulation experience” and interview prompts were given to promote elaboration. This encouraged the participant to begin answering from their own experience and meaning. Based on emergent themes, the interview sequence proceeded to broad questions and probes around thematized topics (Kvale &
Brinkmann, 2009) and eventually to theoretical questions from the semi-structured interview framework as relevant. Leading questions were avoided.

Credibility was further enhanced by two other mechanisms. The use of observation together with interview methods allowed the researcher to avoid decontextualized data collection that could have occurred with the use of only a post simulation interview. The transcript of the simulation observation captured the naturally occurring, situated interaction during the simulation while the post simulation interviews gave participants opportunity to reflect on their own interpretation of meanings and perspectives. Second, the timing of the interviews relative to the simulation experience also enhanced credibility of the findings. All interviews were conducted within 48 hours of the simulation experience with most being conducted within 1-8 hours post simulation. This timing avoided the possibility of significant memory decay among participants and the researcher. Fontana and Frey (2005) refer to this the potential err of memory.

Dependability of the study was supported by a significant audit trail and data corpus. The raw data was indexed in computer files with an accumulated trail of 130 audio files consisting of the individual and group debriefing interviews as well as 36 video files of the simulation encounters. The data corpus then culminated in 94 individual interview transcripts, 36 group debriefing interview transcripts and 36 sets of observation field notes totaling 2780 pages of narrative text. Constant comparative analysis assured that the size of the data corpus still provided meaning-making rather than an overwhelming body of text. Furthermore the audit trail also consisted of a
field notebook of jottings from the simulation observations and a research journal containing the record of the evolving concepts, linkages, and preliminary conceptual model of presence.

Reliability of transcription was addressed throughout the data collection and analysis. The transcription company utilized for this study reported a 98-99% accuracy of transcription. However transcription was regarded as a method of analysis that fundamentally transforms (Kvale, 1996; Kvale & Brinkmann, 2009) the interaction. Verbatim transcription, augmented by researcher’s listening and notation regarding accuracy (MacLean, Meyer, & Estable (2004), pitch, intensity, stress and behavior has been credited with improving both reliability (Seale & Silverman, 1997) and validity (Easton, McComish, & Greenberg, 2000). To check the reliability of the text, all interview transcriptions were read while listening to the audio or video recordings during the first level of analysis. The number of differences between the text and the audiation was verified on the transcript. Transcription codes to indicate differences related to accuracy as well as significant verbal emphases, stresses, or inflections (Kvale & Brinkmann, 2009) were also noted on the text during the first level of analysis. Underlining, ellipses, and narrative codes were utilized for transcription coding of accuracy, emphasis, stress or inflection. Despite these measures, transcription was regarded as interpretive; and, the limitations concerning the ability of transcription to capture the complexity (Sandelowski, 1994) or contextualization (Lapadat & Lindsay, 1999) of the interaction and phenomenon of concern were recognized in the analysis. Measures to attain a quantifiable redundancy
on concepts or theoretical categories by awaiting saturation from different places and multiple participants as Bowan (2008) suggests may have provided a counterbalance to the limitations and reductions of transcription and the related threat of a reduction of the reliability and validity.

Confirmability was also addressed through both member checks and triangulation. Participants were asked near the end of interviews whether they would agree with a concept label/term if the researcher would refer to their experience or meaning using that term. This member check was done within each interview. During the iterative round of sampling where there was a return to the primary sample, concepts from the emergent model were used as terms during later points in the interview process to ascertain the participants’ validation of such a label of their meaning or experience. Following analysis, relevant excerpts of text were submitted to ten percent of participants for validation of meaning. Triangulation was built into the sampling plan of the study. Data was collected from three different institutions and compared between these samples. Additionally through the GT design, data was also collected from comparative groups. For this, non-traditional students, experienced nurses, nursing faculty, simulation directors, and nursing administrators were interviewed. Not only did this support triangulation on the data but it also provided for multidimensionality as Richardson and St. Pierre (2005) have suggested and de-centered the subject from an all knowing position as St. Pierre (2008) and Britzman (1995) have recommended. Furthermore, the grounded theory process of
constant comparative analysis among the groups would be said to support the criterion of comparability (Saumure & Given, 2008).

Erickson (1986) asserted the importance of thick description, evidentiary warrants and discrepant case analysis to account for the evidentiary adequacy in qualitative research. In this study, the significant data corpus provided the basis for thick description and the meaningful use of participants’ words as evidentiary warrant of the concepts and linkages presented in the model of the nature and determinants of presence in HF-HPS for this report. The adequacy of data and the data collection from multiple sources allowed for deliberate search for disconfirming evidence. Discrepant cases were incorporated into the analysis yielding modification of assertions or inclusion in the model as alternative factors or contingencies.

It is for others to judge the evidentiary adequacy of the product of this research. It is upon whether this model is put into use in support of pedagogy and research that will determine the ultimate validity of the research. Therefore, it is likely that Lather’s (1991) criterion of catalytic validity would be the most potent criteria on which to judge the quality of this study.
Chapter 4: Results

*Simulation makes itself easy to love and difficult to doubt. It translates the concrete materials of science, engineering, and design into compelling virtual objects that engage the body as well as the mind.*”

(Turkle, 2009, p. 6-7)

Introduction

What is the nature of presence experienced by nursing students participating in the learning experience of high fidelity human patient simulation? What are the dimensions and processes of presence involved when students enact a role in an artificial simulation learning experience? Chapter four aims to describe the nature of presence and to set forth a conceptual model that seeks to explain the determinants that may bear on presence as well as the articulation of presence as a state of being in simulation as it may impact learning outcomes. The results of the study are presented and discussed around the framework of an emergent conceptual model.
The Nature of Presence in High Fidelity Human Patient Simulation

What is the nature of presence as the state of being that participants experience in interaction with a high fidelity human patient simulation? Is this something that can be understood as distinct from the state of being in interaction with the natural environment of which the HF-HPS is embedded? Consider what this nursing faculty member offered in response to an interview question concerning nursing students’ experience with a dynamic, scenario-based HF-HPS.

You can almost see the students move inside the simulation situation. It’s almost like when you get them past the first five minutes, then it doesn’t matter if it’s a mannequin or a simulation or not. It’s like the situation gets them hooked in. They get hooked into the scenario and the patient situation and they get thinking, and interacting, and being in the situation; and, it all just starts to click like they are in it for real - as if they are the nurse. It seems like it is all about being drawn into the situation. The situation overtakes them. Then it is like they are there - in the real, even though it is still a simulation.

Yet, then, there are some students that come into it just so disconnected. They are dismissive and they never are in it like it is a real thing…They don’t contribute much and they act even a little unprofessional. They laugh or just have behaviors like they are embarrassed at the bedside. You know, you could say that they are even a bit inappropriate to the situation if it was real. They
seem like they are more like watching something happening. ..They don’t seem engaged in it like it is any real situation.

Like nearly all the nursing faculty interview participants expressed, distinct states of being present in HF-HPS were observed in this study. Many nursing students became drawn into the situation in such a way that the simulation situation overtook their focus and attention. The natural environment faded in the background. Their senses were engaged by the stimuli and interactions of the simulation. They became involved cognitively and enacted a care giving role in an embedded psychological state of being and interacted as if on the inside of the patient care situation. A faculty participant described it this way, “It is like they are involved and immersed into it – their focus is really [emphasis] on the patient, and on what’s happening with them, and what they should do about it.” Another stated, “It is like they become tunnel-visioned on the patient and everything else around them is just gone.”

Another state of being also emerged much as described by the first nursing faculty member where students were participating but not from an embedded state of being. Instead, they remained acutely aware of the natural surround as if they were being watched and made to perform. Their focus and attention remained more on the outside of the situation; and, their interaction with the situation displayed a degree of self consciousness, dismissiveness, and disconnection. They were observed standing back and watching almost as if uncomfortably waiting to be forced into becoming involved in the situation. One faculty participant described this state of being as such.
They don’t feel that it is real because they are being forced into talking to a dummy. You can really see if they are not engaged in the simulation. They start having their own personal conversations socially outside of the situation. They are like outside the scenario. You can really see that they are not immersed and not present in it. In fact they act even a little bored. Or they are dismissive when they do something wrong and they say, “Oh well, it isn’t real anyway.” They are just out of it in a way even while they have to carry out the required tasks. They do it like that it is just pretending.

**Presence Centricity.** The two states of being that were evident in the observations and interviews regarding nursing students participating in HF-HPS exhibited a centricity on the inside or outside of the simulation. These states can be conceptualized as endocentric and exocentric presence relative to whether the stimuli derived from the simulation environment or the stimuli derived from the natural environment was the dominant perception of the participant that located their being, conditioned meaning, and mediated on interaction in the situation. Endocentric presence is conceived as a dominant perception of “being there,” as Minsky (1980) would say, and enacting the self in a role in a real patient care situation represented by the simulation. Endocentric presence is indicated by a state of immersion (sensory-perceptual envelopment) and involvement (focus/attention/action) in the simulation situation as Witmer and Singer (1998) have also described of presence in computer simulations. In contrast, exocentric presence is conceived as a dominant state of being
in and interacting with the natural environment where the meaning of the simulation environment is perceived strongly as artificial. The participant enacts the self in a role from an outsider perspective disconnected from the simulated patient care situation. Their interactions and actions with the simulation are thereby constrained by the meaning of the artificial environment and the dominance of perceived stimuli of the natural environment.

Out of the voices of student participants also emerged the nature of presence having centricity of endocentric and exocentric presence. Students similarly characterized their experience in HF-HPS as a state of being either inside the simulation situation or on the outside of the situation. This is evident in the contrast between the following two nursing students’ descriptions of their experiences in HF-HPS scenarios.

The first student’s account reflects an endocentric state of being. Notice the dominance of the patient situation over the proximal environment and the perception of being there in a real patient care circumstance in this statement.

Well, the patient was my main concern. At first it was pain; it was hurting her and that was my concern. Then the second thing, it was the hemorrhage; and, we had to try to keep the patient calm while we had to deal with the blood transfusion. I felt like a nurse. It was like you see one thing and the next in the simulation and you focus on that and do something to fix it. You kind of forget the fake picture. Do you know what I mean? You get involved in the
situation like it is real. You don’t even notice other things around you while you are involved in it, you know?

In contrast, this student recounted a more exocentric state of being in the simulation. Notice in this narration of her experience, that the student was highly aware of the artificiality of the simulation activity and was concerned with the observers and facilitators in the proximal, natural environment. The dominance of the natural environment seemed to mediate on her perception, actions, and experience.

I felt so awkward. I don’t know if it’s just because of in my mind - I know it’s fake. I guess I just felt like I was outside like watching everybody inside paying attention and attending to it. It felt unnatural almost. I know I was busy with stuff, like just doing the tasks, like I was going through the motions, like it would be scripted. I wasn’t really worried about the patient or that I am going to hurt anything. I was just thinking about the people in the booth, and the teacher watching, and it just doesn’t make it seem real to me at all. It is just a weird psychological thing, you know?

States of being present in HF-HPS seemed less about the experience of being in one or the other of discrete, exclusive, and alternate framings. Instead, presence in this study was more often bicentric in nature. Bicentric presence in HF-HPS is a state of being were both the simulation and the natural environment are perceived and experienced dynamically at varying degrees of intensity. In this state of being, the
degree of perception and action are generally centered with greater intensity in one environment or the other. Said another way, there is a degree of salience or degree of overtake by the simulation environment; yet, the participant remains aware of the primary environment to some degree. This is consistent with the simultaneous experience of both a natural and a virtual environment that has been described of presence in other types of simulation environments (Draper et al., 1998; Slater, 2002; Ijsselsteijn, 2002; Rettie 2004).

The experience of the majority of students in this study can be interpreted as being a more bicentric state of presence where students were predominantly aware and interacted in one environment yet still maintained awareness and interaction with the other. The following student’s passage was representative of a majority of descriptions of students' experience of bicentricity in HF-HPS: “Yea, the simulation was real and not real enough at the same time…I felt right in-between. Yes, right in-between something real and not real at the same time. Like one foot in and one foot out.” Another student described a bicentric state of being in simulation where starting from an endocentric position, her awareness of the natural environment, exocentricity, became salient. “I started out very focused on the situation. I was working with the primary nurse to figure out how we should get things accomplished. But then, sometimes, I feel, just like laughing like, this isn’t real, and I feel like I pulled right of the situation.”
Another student also spoke about a salience of presence as she described how the stimuli from the patient condition in the simulation overtook her from a more exocentric state to a more endocentric state of being.

It was kind of an odd experience. Like at first you feel silly taking it seriously because he isn’t real. You feel at first like you are just yourself pretending. But at the same time, once he started to decline and he went into V-fib, I kind of had this sense of urgency to fix it. I got nervous and the adrenalin was pumping. Even though I knew he wasn’t a real patient, it got so nerve wracking because you kind of put yourself in the real scenario. It was this sense of urgency that came over me that kind of surprised me. It kind of put me there like in a real life situation. I had the sense of fear that the patient would be dying – that sense of fear that I would have if it were real.

As seen in these examples, bicentric presence is a dynamic state where the student moves in between the proximal and the simulation environment. At times this is a gradual shift from one environment to the other where students are drawn in by the situation from an exocentric state of being on the outside of the situation to an endocentric state of being on the inside of a realistic patient situation represented in the simulation. Yet in the example of the student that described a sense of being “pulled out of the situation” the perceptual and attentional shifting (Ijsselsteijn, 2002) can also be more fully in or out of the simulation to more discrete states of endo - or
exo-centricity. This abrupt shift in presence is aligned with the concept of breaks in presence as originally defined by Slater and Steed (2002) and Brogni et al. (2003) where participants in simulation stop attending to the stimuli of the virtual environment and attend more to the stimuli from the natural environment.

Breaks in presence seemed at times facilitative and at other times seemed counterproductive to maintaining or restoring an endocentric state of being relative to the salience of the HF-HPS environment among these study participants. Students participating in HF-HPS are called upon to enact the role of the nurse requiring skills for which they may or may have full knowledge or competency to perform. It is in this case that breaks in presence most often occurred where the student chose to draw on the natural environment by asking the instructor or the facilitator for assistance. At other times, instructors broke presence by interrupting the scenario from the outside to draw the student’s attention to a cue in the simulation, to assist in task performance, or to prompt clinical reasoning regarding the patient situation. The examples that follow seem to illustrate that a student selected break in presence was facilitative; whereas, an instructor initiated break in presence seemed counterproductive.

This student described a situation where the break in presence facilitated endocentric presence in the simulation.

Sometimes we stopped to ask the teacher a question. I remember that I kind of stopped and turned to her and asked the question because she was sitting right out there, but not really. But then I went right back into the situation doing something with the patient and I was really into it again. Sometimes you just
need to get a thing that you don’t know answered so you can go on in the situation.

Another student explained why a break in presence can be facilitative. “Well sometimes it was necessary to ask a question because if we didn’t, we would have been stumbling or just frozen. It is like you just put it on pause to ask a question and then un-pause and start up again right from where you were.”

Yet in this situation, a break in presence was counterproductive. Here the student described a state of moving to a completely exocentric state of being in the simulation when the instructor initiated a teaching moment in the simulation. Her words conveyed a sense that part of the learning experience was lost by this shift.

When she jumped in and started doing things in the simulation and talking about things in the simulation, it was pretty much over for me. I would say that it just broke me out of the simulation, and now it was just a lab situation again, and it just turned into a teaching session, again. That was OK. But, if the point was for us to go through a realistic patient care situation, it was all over after that.

Three presence states were evident through the observations and the interviews of the participants. Dimensions of these states also clearly emerged from this data. Endocentric presence was characterized by a sense of “being there” or “putting oneself,” in the framing of a real patient care situation.” Once there, those that were endocentrically present in HF-HPS were observed to have high levels of immersion,
focus, and attention and to be less influenced by distractions in the surrounding natural environment. This seemed to foster high cue sensitivity and a sense of agency in the situation. Endocentric presence also seemed characterized by emotional responses related to the care situation such as a sense of urgency, nervousness, fear, or compassion. Participants experiencing an endocentric presence perceived a connection to the patient situation and felt a sense of responsibility and accountability for the patient status in the simulation as can be seen in the responses aforementioned.

In contrast participants that experienced a more exocentric presence framed themselves outside the patient care situation resisting or feeling forced into being in the situation. The focus and attention appeared to be more on others in the natural environment and on the self as a performer in the situation. These participants exhibited reduced cue sensitivity and higher levels of distractibility. They perceived the situation as artificial and inconsequential fostering low levels of agency, perceived emotion, or accountability.

Bicentric presence was observed to be the most common state of being present in HF-HPS. This state of being was characterized by the participant’s perception of and interaction with both the natural and the simulation environment at some level of salience of one over the other. Bicentricity was further characterized by a salience of presence where either endocentricity or exocentricity was dominant and where the participant was always aware of the other environment shifting attention (Ijsselsteijn, 2002) between the proximal and the simulation environment.
HF-HPS as an augmented virtuality is always embedded in the natural environment. By nature then, this hybrid form of simulation mixes the natural environment (human interactions in the patient care situation) and the virtual (artificial patient, computer displays, and scenario) involving a participant simultaneously being in both the natural and the virtual environments. Natural human interactions between participants are integral to the enactment of the simulation. Outside facilitators are required for the implementation of the scenario states and stimuli. Therefore, the proximal and the simulation environments co-exist and may mediate on the participant experience in variable ways. Participants perceive the stimuli from the environments simultaneously, dynamically, and at some level of salience one over the other.

The conceptualization of the nature of presence in nursing students participating in scenario based HF-HPS is presented in Figure 3. Presence in HF-HPS is a dynamic state of being between the primary domains of endocentricity or exocentricity. These concepts refer to the dominant positionality or the centricity of participants’ state of being having sensory, perceptual, and actional dominance either on the inside or the outside of a real situation represented by the simulation that is embedded in a proximal, natural environment. The peripheral rectangle in Figure 3 represents the natural, proximal environment shown by the dark shading. The simulation environment is shown embedded within and is represented in the model by the lighter shaded expanding triangle. Endocentric presence is shown where the simulation environment is dominant and the degree of dominance is denoted by the
size of the lighter shaded area of an expanding triangle embedded in the rectangle.
Exocentric presence is shown in the model by the size of the area of the dark rectangle representing the degree of dominance of the proximal, natural environment. The broken line on the expanding triangle in Figure 3 represents a permeable boundary between the proximal and the simulation environments denoting where stimuli from either environment may co-mingle with the other. The intensity of comingling of stimuli between the natural and the simulation environments is represented by the gradient of color shading within the expanding triangle.
The expanding triangle within the model represents the degree of salience concerning the dominance of the simulation environment perceived by the participant. Participants are shown in the model by the diamonds at various positions on a continuum within the expanding triangle representing the state of being and
degree of sensory overtake by the stimuli of the simulation environment. Positions of participants at the wide end of the triangle represent a more endocentric presence where the simulation environment is perceived with greater intensity; whereas, positions of participants at the pointed end of the triangle represent a more exocentric presence where participants are involved in the simulation environment to some degree but perceive the natural environment with greater intensity. The embeddedness of the expanding triangle of endocentricity together with the permeable boundary suggests, then, the nature of bicentricity of presence in HF-HPS.

The Determinants of Presence in High Fidelity Human Patient Simulation

A goal of high fidelity human patient simulation is to induce the experience of endocentric presence in an artificially constructed reality of a clinical situation. The nature of high fidelity human patient simulation, as a mixed reality form that intermingles stimuli from the virtual and the local/natural environmental contexts, (Milgram & Kishino, 1994; Benyon, 2006: Wagner et al., 2009) logically makes the state of endocentric presence rather complex. In this study, multiple determinants of presence in HF-HPS emerged through the observations and interviews (see Figure 4). The determinants of presence can be clustered into the broad categories of pedagogical factors, individual factors of learners, and group factors. Pedagogical factors included the determinants of: simulation design, stream of stimuli, and instructional process. Individual learner factors included: personality characteristics, referential experience,
preconceptions, emotional responses, and entry competencies. Group factors included: group dynamics and structural factors.

**Determinants of Presence**

**Pedagogical Factors**
- Simulation Design
- Stream of Stimuli
- Instructional Process

**Individual Factors**
- Personality Characteristics
- Referential Experiences
- Preconceptions
- Emotional Responses
- Entry Competencies

**Group Factors**
- Dynamics
- Structure

**Centricity of Presence**

**Endocentric Presence**

**Exocentric Presence**

**Key**
- Natural Environment
- Simulation Environment
- Participants

![Figure 4. The Determinants of Presence in High Fidelity Human Patient Simulation](image)

**Pedagogical factors.** Broadly, pedagogical factors are those factors that relate to the instructional/learning strategy, design, method, style, and activities. Factors found to influence presence in HF-HPS include simulation design, stream of stimuli, and instructional processes. The category of pedagogical factors in this model is
parallel to the categories of simulation design and educational practices in the Nursing Education Simulation Framework (Jeffries, 2005, 2007). The category recombines the factors that relate to instructional design and method into one category, pedagogical factors. The sub-category, stream of stimuli, as a determinant of presence in this model, is an instructional implementation factor that relates to Jeffries (2007) elements of student support and fidelity features in the simulation design category of the Nursing Education Simulation Framework.

**Simulation design.** Simulation design characteristics generally are thought to concern the features of objectives, fidelity, problem solving, student support, and reflective thinking/debriefing (Jeffries & Rogers, 2007). In this study, the purpose of the simulation as well as specific learning objectives were at play. Features of the scenario and of fidelity also had bearing on the centricity and salience of presence experienced of participants.

**Purpose or objectives.** Simulation can be used with the purpose of instruction, assessment, or evaluation. Most frequently HF-HPS is used as an instructional activity in nursing education (Hovancsek, 2007). In fact, the use of high stakes testing with HF-HPS is currently debated in nursing due to the limitations and mechanical difficulties of the human patient simulator (HPS) technology, lack of reliability, and validity testing on methods of evaluation with HPS (Hovancsek, 2007), and uncontrolled interactional circumstances inherent in the nature of HF-HPS as a mixed reality form.
The use of HF-HPS as an evaluational method as well as the participant’s perception of being evaluated even when HF-HPS was used as an instructional method impacted the centricity of presence in the simulation. When participants were aware that the purpose of the simulation was for competency evaluation, they experienced higher anxiety, concern over being watched, and suspicion of being set up or tricked leading to more exocentricity. Similarly, participants in instructionally based simulations that perceived they were being evaluated, although they were not, still experienced anxiety, concern with being watched, and a more exocentric presence. This was evident in a representative statement from this faculty member.

It depends a lot on the [purpose]. It is very different if they feel like they are being evaluated. Then they are more like in the performing role and not engaging in the scenario. Instead they are more concerned with the teacher.

All of the simulations observed for the primary sample of prelicensure nursing students and the comparative sample of 2nd degree prelicensure nursing students had an instructionally based purpose. In fact, in all cases, the simulation experience was a non-graded learning activity. Only the written pre-simulation, preparatory assignment was a graded component. Students were oriented to each of the simulations. In all cases, they were reminded that the simulation was to be regarded as a “safe learning experience” and that they were not being evaluated. Nevertheless, over 90% of the primary sample of nursing students recounted high levels of performance anxiety. Over half of the time, the performance anxiety was related to the perception
of being evaluated by the instructor.

One student reported her perception of being evaluated in an instructionally based HF-HPS experience. Here she explained also how this perception impacted her focus, attention, and actional components of presence.

I was really aware of the teacher over in the corner. I feel like she was watching me and evaluating what I was doing. I wasn’t completely focused on it. My mind was still in the clinical situation. But it was always in the back of my mind. I mean, I was aware of it (the teacher), but I could still keep going and do what I needed to do.

Her description of this experience reflects a bicentric presence where she was aware of elements in both the proximal/natural environment as well as in the simulation environment. In this case as in many others, the salience of both the natural and the simulation environment seemed relatively equal and the permeability of the boundary between the natural and the virtual seemed evident as she described that her mind and her actions kept going in the simulation but that the sense of being watched and evaluated was always entering in.

Similarly, this student acknowledged that the purpose of the simulation was instructional. But, the impact of her perception of being evaluated was also evident in her words. Her more exocentric presence characterized by her focus outside the simulation situation on the teacher is clear.

It is very stressful having your instructor in there and watching you so closely because you know, even if they say this is just a learning experience, but they
are going to still see you make mistakes, and they will remember what you did wrong. So they are [with emphasis] still evaluating. So that is in your mind when you are going through it.

Simulations that did have a stated purpose for competency evaluation had an even greater impact on presence centricity. This was evident in the comparative group of staff nurses. Half of the simulations for this group were for the purpose of annual competency evaluation. The other half of the simulations were instructional; however, they were perceived as evaluational by participants since the simulations were conducted at the conclusion of a four month nurse internship program. One nurse reported: “I just felt like this was a test that wasn’t even fair, that is all I was thinking about.” Similarly another nurse reported how her perception of being evaluated overrode her perceptions of the simulation.

I just know that they were evaluating me on some things. I knew that they wouldn’t want to tell us what was going to happen with the patient. We were only told it would be a failure to rescue simulation. But at least we should have known the types of things that they were looking for so that we didn’t have to focus so much on being worried about that instead of thinking about the simulation. That’s probably why I didn’t act like I normally would have.

Learning objectives operationalize the purpose and goals of an instructional strategy. They specify the cognitive, psychomotor, and/or affective outcomes.
(Morrison, Ross, & Kemp, 2007) that the simulation activity should enable. Objectives function to guide the design of the learning activity, provide the framework for evaluating learning, and guide the learner through the process of achieving the learning goal (Morrison et al., 2007; Jeffries, 2007; Hertel & Millis, 2002; Bastable, 2008). Learning objectives for simulations in nursing education tend to most directly address either the goals of psychomotor skill attainment or higher order critical thinking and clinical judgment goals around clinical problems. When the purpose of simulation is oriented toward the goal of achieving skill or task competency, an exocentric presence is expected since the simulation is typically instructor-driven. For, dynamic, scenario-based HF-HPS, an endocentric presence is desired (Dieckmann et al., 2003) to enable problem solving and clinical judgment. Therefore, endocentric presence in HF-HPS is also theorized here to enhance these learning outcomes. One nursing faculty participant stated it this way.

The [learning objectives] in the simulation are part of it [referring to immersive presence]. See in the first simulation that we do in the semester, I just want them to learn the steps of the code. They have never been in a code or done some of the skills yet. So I am showing them and stopping in the middle of things to teach them the medications and the procedures. I am not expecting them to be immersed in a real situation. But the goal of them being in the second simulation in the semester is very different after they have had 200 hours of clinical experience and already know the meds and skills. So for the second one, I want to run the scenario and let them recognize the change in
patient status and make the decisions on how to handle it on their own. I try to stay on the outside of it and want them to be immersed like it is real this time through.

Scenario design. The scenario itself is a simulation design factor that also impacts the centricity of presence in HF-HPS. Scenario design is a scripted template for enactment through a clinical problem as well as a constructed context of factors related to the fidelity to the patient care situation including the environment, equipment, medication/fluids, diagnostics, documentation forms, roles, (Childs, Sepples, & Chambers, 2007) resources, and processes. The scenario progression and factors of fidelity were found to either induce or inhibit an endocentric presence. Role factors also had bearing on presence. However, in the presence model generated from this study, role is considered a group interaction factor as a determinant of presence and will therefore be discussed with group interaction factors later in this chapter.

Dynamic scenario based HF-HPS design typically includes a patient clinical situation that runs through a progression of dynamic physiologic changes in states and responses to nursing interventions aimed at solving the patient problem. The observations of 36 HF-HPS encounters included four different scenario designs including the clinical problems of post-surgical hemorrhage, acute myocardial infarction, cardiogenic shock, and sepsis. The nature of presence was compared across these different scenario designs. No specific differences in presence responses were noted based on the type of the patient clinical problem represented in the simulation.
However, the change in physiologic states and the cues indicating those state changes seemed to be a strong factor invoking the salience of the simulation environment and a more endocentric presence of participants.

The observations of the HF-HPS scenarios revealed that as the physiologic or psychological state of the simulated patient changed, the cues of this state change designed in the scenario captured the attention, focus, and actional engagement of participants. Participants often started off standing on the periphery of the situation in a more disconnected and observational mode. Then as the state change became evident, the simulation environment became more dominant through a sensory-perceptual overtake by the cue stimulation derived from the simulation environment. Students perceived cues on the monitors, through the voice of the patient, from laboratory report props and through prompts of facilitators either directing participants’ attention to a cue or assisting in the clinical reasoning through the data presentation. Recognition of the change in state of the simulated patient seemed to draw participants into the clinical situation to a state of being endocentrically present in the simulation and moved them into action in the situation.

This status of being drawn into the situation by the design of state changes in the simulation was observed by faculty participants and was also recounted by both nursing students and professional nurse participants. A typical description of faculty was that, “the scenario itself, affects how engaged the students are in the simulation. When the situation is more intense, or when the scenario has changes in states, they are definitely more engaged.” Another teacher felt that “the change in the patient and
intensity of the cues and prompts makes a difference.” This nurse’s words capture the phenomenon of being *drawn in* by the state changes in the scenario.

Well, when the patient’s symptoms get changing, that status of the patient just like gets you into it and all involved in it. You realize, oh-ah, he is coding and you get that real nervous feeling. Like, OK, what am I gonna do next? You feel pressure like, oh gosh, we have to try to bring him back, so you are like really focusing on his changing status.

Similarly, this student recounted the sensory overtake of the simulation situation.

Things were happening so fast and it was so realistic! Her blood pressure was decreasing, her pulse was getting tacky, she was bleeding. I was so focused on all that, that I didn’t feel like anybody was even in the room with us.

Like many others, this student described the shift to endocentric presence in the simulation that was influenced by the patient’s change in status.

I was just standing there when we started. Then when stuff started happening and I realized he was coding, it got so nerve wracking. I knew it wasn’t real, but you just put yourself in a real scenario anyway. I found myself rushing to grab the stool to start compressions….All I could focus on was trying to hear the instructions. I was on a mission. I was going to bring him back!

*Fidelity factors.* Fidelity in regard to simulation is generally considered to be the level of realism represented in the artificial construction of that reality. Dynamic scenario based simulations using computer driven mannequins are considered to have
high fidelity – hence, the reference in the name, high-fidelity human patient simulation. One aim of simulation design then is to develop the artificially constructed situation as closely to the real clinical situation as possible (Jeffries & Rogers, 2007; Medley & Horne, 2005). In HF-HPS, fidelity factors typically include scripting the patient history and progression of the clinical problem, programming, equipping and making up the patient simulator to mimic the clinical problem, scripting the verbal responses of the simulator and facilitator roles for cues and prompts, designing and equipping the environment/setting with supplies, resources and processes. Fidelity factors as they contribute to realism, then, naturally impact centricity of presence in the simulation.

All the faculty participants in the study addressed the importance of fidelity concerning participants’ experience in simulation. In particular, faculty made reference to immersion and engagement, both dimensions of presence, and to distraction or disorientation, both inhibitors of presence. These teachers described fidelity factors that facilitated immersion and engagement. “I think they are more immersed and engaged when we have a live person speaking for the mannequin and not the preset computer voice because of that ability to converse and see the patient react.” This teacher also said, “I think having the mannequin dressed and made up realistically is important to their engagement. Other faculty members described inhibitory factors of fidelity. “It is very disorienting if the processes are not the same. They need to have the equipment and the processes as close to real as possible.”
faculty director of a simulation lab recounted the impact of fidelity factors on engagement of participants:

I think it is really important to make the processes as real as they can be. Of course we have to draw the line on things that are cost prohibitive. But it is very confusing and disorienting when processes and equipment are different than what is in practice. They start wondering if this is part of the simulation or not. If they have to think about that, then they are not fully engaged in the simulation.

Similarly all student participants mentioned realism or the lack of realism as a facilitative or inhibitory factor on their experience of being in the simulation. A range of fidelity factors were accounted for in their responses. These students reported how high fidelity impacted them and facilitated their engagement. One student said, “He was blinking and he could respond to my questions. It was a real voice…the fact that he was so realistic really gets you into it.” Another student addressed the process fidelity. “We got to go actually push meds into the CVC. We got to do all those processes to get blood from the blood bank and then we really hung the blood. I really felt like the nurse.” Yet, other students reported on the inhibitory effects of low fidelity factors when either processes varied, equipment was unavailable, or when the patient did not seem real. A representative comment from one student was, “Everything was wrong…They didn’t have gloves. We had different paperwork. The meds were not in the right vials. It was so confusing.” Another student
commenting on the mannequin stated the following.

It was so strange to try to talk to the mannequin, an inanimate object. The responses really didn’t seem like they were coming from the patient to you especially since part of the time it was a male voice then suddenly a female voice! That just breaks your concentration.

Fidelity factors had even a more pronounced impact on professional nurses participating in HF-HPS. The nurses in this study felt more extreme disorientation over differences in processes from their clinical practice. They also expressed concern over how the lack of equipment and process fidelity impacted their performance and increased anxiety in the simulation. One nurse put it this way.

This was just nothing like real. I was so disoriented. I didn’t have the same processes and routines that I usually go by on the unit when I am assessing my patients. …. See, I usually have more information before I go into the room. I look things up and write things down on my worksheet in a certain way to trigger me when I go in the room. In the simulation, we had nothing to write on or take with us to the bedside. Plus, I usually take supplies and equipment in the room and that triggers me to ask and do certain things. This had so many different processes and I didn’t know how to get supplies. I knew they had them all piled on a cart, but you would have to look through everything to find what you need. Nothing was labeled properly. I am sure that is why I just
was frozen and why I made that medication error in the simulation.

Other nurses had similar responses. This nurse recounted the impact of process fidelity and the impact on her state of being in the simulation. “I really didn’t know what they wanted me to do. I didn’t know how to get the meds. There was no MedAdmin® system and no Pyxis®. I had to keep asking them…That just kept breaking the flow and made me very tense…very tense[with emphasis] and anxious.”

**Stream of stimuli.** Witmer and Singer (1998), Witmer et al. (2005) and other scholars consider immersion to be a fundamental dimension of presence in simulation. Their conceptualization is that immersion is “a psychological state of being enveloped by, included in, and interacting with an environment that provides a continuous stream of stimuli and experience” (p. 277). Drawing on Witmer and Singer’s (1998) and Witmer’s et al. (2005) conceptualization, immersion involves sensory-perceptual salience of stimuli generated from the simulation environment. Immersion involves, then, a psychological fulfillment or an overtake of the sensory-perceptual stimuli generated from the primary natural environment. Therefore, immersion, a primary dimension of presence, is highly dependent on the stream of stimuli generated from the simulation environment.

Stream of stimuli is an implementation factor of HF-HPS that may be more complex in comparison to fully virtual simulations since HF-HPS is a mixed reality form of simulation that inter-mingles human and non human elements. Additionally elements of the HF-HPS inter-mingle with and interact with elements of the natural
environment. The stream of stimuli generated from the HF-HPS environment is produced through data, cues, and prompts given from the mannequin operator, educator/facilitator, and other cueing mechanisms such as monitor data output, patient records, patient reports, and scripted role enactments. The stream of stimuli generates the scenario progression, and facilitates the participants through the problem solving process in the clinical situation represented in the scenario. In this study, the stream of stimuli was found to be a strong determinant of presence by its impact on immersion. The elements of pace and foci concerning the stream of stimuli generated from a HF-HPS emerged from the data in this study.

**Pace of stimuli.** Scenario progression is a part of the overall simulation design. As such, the pace of stimuli in the scenario is on one level apportioned to the timing of the sequence of physiologic/psychological state changes established for the clinical situation designed for a dynamic scenario. Within each physiologic/psychological state designed in the sequence of the scenario are also holding patterns that give participants time for assessment, cue recognition, clinical reasoning/judgment, and clinical interventions. Throughout both static and dynamic states, a stream of stimuli is delivered to participants through data, cues, and prompts. The pace of this stream is determined both by the design of the scenario progression and by the judgment of the actors, operators, and/or facilitators. Pacing can also be altered as a result of, or in response to, the interactions and interventions of the participants. Pace is further affected by the acceleration of real time in simulation to enact a real patient situation in an allotted laboratory time frame.
Pacing the stream of stimuli either too fast or too slow in a dynamic, scenario based simulation alters immersion and consequently the centricity of presence in participants. When the pace is slow, there is a lack of sensory-perceptual fulfillment. Attention and focus on the simulation diminishes and a shift of attention to the natural environment, an exocentric presence, occurs. When the stream of stimuli is paced too fast, participants become overwhelmed and over stimulated. Focus of participants may, then, become diffuse. Participants may completely miss cues or prompts or even become frozen in their state of being in the simulation. This too leads to attentional shifts to the outside and an exo-dominant bicentricity as participants seek assistance or relief from cognitive overload.

Nearly all faculty facilitators or simulator operators described the challenge of pacing the data, cues, and prompts in the simulation. One instructor facilitator/operator put it this way:

If you move very quickly in the scenario, it can be very frustrating for the students. They get frazzled especially if they are not yet adept at what they are doing. I have seen them cry, or get angry, or not work well together as a team. They start falling apart when that happens…If it is too slow, then they come out of it and they start talking about other things that are going on in their lives and they are not focused on the simulation. So I try to pace them to keep them on track and to keep them engaged in the scenario.

Another teacher alluded to the importance of the engagement of the simulation operator in the scenario to affect pacing stimuli to keep students engaged.
I have to give them enough patient data and cues right in the beginning to pull them into it. Otherwise if the cues are too subtle and slow at the beginning, they are all just standing back watching and not really engaged…If they are trying to do a task, I have to let Mrs. S [the mannequin] go to sleep so that they can focus on implementing the intervention otherwise they just ignore or dismiss her cues like they are screening it out. You know, this stuff is not in the script or in some textbook. Really the person running the mannequin has to be pretty engaged in it too.

Similar patterns of immersion were expressed by the student participants. One student described how, “Everything is thrown at you all at once, so your focus just scatters.” When the pace of the stimuli in the stimulation was too slow another student stated, “When everything was moving so slow, it was distracting. I was thinking that we need to get things done and we don’t need to let her get any worse.”

Evidence of cognitive overload was also pronounced in the professional nurse participants when the pacing of the stream of stimuli was too fast. One nurse stated, “I was so disoriented that I didn’t even notice everything about what was happening to him. The other nurse had to cue me in to seeing the monitor when he went into fibrillation. It felt so chaotic.” Similarly, another nurse was overwhelmed by the stream of stimuli in her simulation experience.

Everything was so rushed. They kept changing everything. Everything was just coming so fast, you didn’t even have time to finish what you had just started to assess or do and they were throwing something else at you. I just
couldn’t keep up. With a real patient and if something was going wrong like this, we would have called for help; we would call an ERT [emergency response team]. Then a team of doctors, residents and other nurses come and we would do things as a team.

*Scenario Foci.* The focus points in a scenario-based simulation are also a part of scenario design. Foci include not only the primary patient problem that the participants must solve and treat but also include any other learning objectives, learning activities, physiological states, psychomotor skills, and psycho-social aspects that accompany the clinical situation and require the participant’s attention in the simulation. Foci are important elements in design consideration since they contribute to not only the realism and complexity of the simulation but also to the distraction away from the focus on the primary patient problem or learning objective. As such, foci become another source of stimuli for the participants in the simulation.

Focus points in a simulation are typically related to the clinical situation and contribute to the realism of the clinical situation. Jeffries and Rogers (2007) have suggested that the complexity of a simulation design should reflect the purpose of the learning experience, the learners’ ability, and should present a challenging, problem solving situation. But complexity of the simulation may also reduce the effectiveness of the learning experience or may overload the learner (Jeffries & Rogers, 2007; Rauen, 2001). The challenge here is in trying to achieve a match between the cognitive, psychomotor, and affective demand of the simulation with skill level of the learners.
Faculty participants highlighted the challenge of designing simulations with foci relevant to the clinical situation, challenging for the learning situation, yet not overwhelming to the learning experience. This faculty member reflected on this challenge.

I think it is really important to keep the sim as focused as possible and to have realistic expectation of what you will have them [participants] do in a sim. I’ve been in some sims where other people have written in so many tasks into the scenario. They think they are making it more realistic. But there are too many problems for the time period of a sim. To me, a sim should have one key problem or one core issue like a hemorrhage or a code. Not a hemorrhage, bowel obstruction, disrhythmia and a psychological problem all at the same time. It is important just to decide what the learning objectives are to teach students and to keep it focused on that one problem and the things very directly related to that problem.

Several other faculty participants spoke to the learning experience when too many foci were included in a simulation.

When you have too much in the simulation, then things just start going over their head. We whittled this scenario down because when there are so many things that they had to deal with like nausea, pain, dressing changes, catheters, IVs, and hemorrhage. Then students don’t know what to take care of first. It becomes hard for them to prioritize and you see them just get
frustrated with it all.

This faculty member further described how she purposely reduces or increases the intensity of foci during the implementation to allow students to focus and process on the primary problem.

You can’t throw so much stimulation at them all at once when they need to think and focus on something. I make the mannequin go to sleep at those moments and it lets them focus… it keeps their attention and concentration on the tasks that they haven’t had much experience with. Or sometimes you have to draw their attention to something. So in that case, I dial up the intensity. I had a case last week where the patient had V-tack. They didn’t notice because they were focused on something else. So I got more intense about. I had the mannequin complain that her chest was hurting and that she felt like her heart was beating funny to get them to notice the monitor.

Students and professional nurse participants spoke of the difficulty focusing on the primary problem when they became overwhelmed with stimuli related to foci in simulation. This student stated: “The patient just kept complaining and throwing up and throwing up. It was so distracting, I even was annoyed by it…we couldn’t even get to treating her because we kept having to go back with the emesis basin so many times.” Similarly a professional nurse participant shared how the number of foci impacted her learning experience negatively causing her to suspect an unreality of the situation.
Sometimes when they are making so much stuff happen and giving you so many clues, you just get the feeling like they are saying things to throw you off. So you don’t know what to take seriously in the simulation. You are trying to read into what is happening because it is half pretend.

*Cognitive Load.* The stream of stimuli in relation to pace and foci had a combined impact on the cognitive load of students and professional nurse participants. When pace or foci reached a level where participants were overwhelmed, they were either unable to focus or attend to stimuli or they became frustrated, frozen, or even suspicious. This impact had a rather direct effect of decreased immersion and presence in the simulation environment.

Cognitive load theory (CLT) lends insight here. Cognitive load theory refers to the information processing capacity of working memory versus long term memory. An assumption of CLT is that there is a limited capacity of working memory and a connection to long term memory (Baddeley, 1986, 1999). Characteristics of the learner, task complexity, environment, nature, and presentation of the material are all thought to bear on the cognitive load of the learner (Paas & vanMerrienboer, 1993). CLT posits that cognitive overload occurs when the cognitive capacity is exceeded in a learning activity where learners become overwhelmed by the number of information elements and interactions that need to be processed ultimately impacting meaningful learning (Paas, Renkl, & Sweller, 2004).

There is an assumption that technology based learning activities enhance
learning. Yet, the application of technology to the learning situation is no guarantee of student performance (Bransford, Brown, & Cocking, 2000). A high potential of cognitive overload from a learning experience by HF-HPS was evidenced in both the observations and interviews from this study. Such cognitive overload altered presence and consequently had the potential of a negative impact on the learning experience and learning outcomes among participants in those cases.

**Instructional process.** Teachers or educators are involved with HF-HPS in a variety of roles including but not limited to: establishing learning objectives, designing the scenario, operating the technology, implementing/facilitating the simulation, enacting a role in the scenario, or evaluating the participants and learning outcomes. The teacher/educator and the collaboration of the teacher/educator with the student (Billings & Halstead, 2005) have been identified as factors in the Nursing Education Simulation Framework that may impact learning outcomes (Jeffries & Rogers, 2007). Similarly, in this study, the involvement of the teacher was found to have significant impact on presence.

Faculty influences have been discussed earlier in relation to the nature of presence and as a factor in simulation design and stream of stimuli. In specific, the instructional process here refers to the facilitation process and the nature of student-teacher collaboration during the implementation of the simulation. The instructional process during scenario implementation was found to be a pedagogical factor that was a determinant of presence in HF-HPS. The relationship with the faculty as well as the
nature and style of facilitation were found to stimulate either a more endocentric or exocentric state of presence.

In all of the simulations involving the primary sample of prelicensure nursing students or the comparative sample of second degree, prelicensure nursing students in this study, the students’ clinical faculty served in a dual role as the facilitator and the prescriber. Instructors that were on staff in the simulation lab also served in support roles as the technology operators. For the simulations involving the comparative sample of professional nurses, one nurse educator served in the role of technology operator, a second nurse educator served as both the prescriber and facilitator, and either a nurse educator or nurse manager served as an evaluator.

All of the faculty or nurse educators that served as facilitators of simulations in this study had a formal relationship with the nursing students or professional nurses participating in the simulations. This relationship preceded the simulation experience. For the nursing students, the relationship was such that the clinical faculty for the student was in the same course for which the simulation was a course requirement. While the simulation was a non-graded experience, the faculty member did have responsibility for clinical evaluation of the student for the course. In the case of the professional nurses, the facilitator educator was known to the participants as a clinical specialist in the department of learning and education for the hospital. Additionally, the nurse manager that was responsible for employee evaluation was observing the simulation activity. While the simulation was considered to be an educational and training activity, the experience was associated with the annual competency
assessment. In all the simulations, during the orientation to the activity, the nursing students were informed that it was a non-graded learning activity and a safe learning environment where they were not expected to have proficiency. Similarly, the professional nurses were told in the orientation to the activity that it was a safe environment and that it would provide an opportunity to assess their skills.

Regardless of the fact that the simulation was established to be a low threat learning environment, the connection of the teacher with course evaluation or with job evaluation seemed to impact the nature of presence in the learning experience of participants. Students and professional nurses alike were acutely aware of the potential of being evaluated on their performance in the simulation. This awareness occupied a part of their attention effectuating a more bicentric presence. A nursing student put it this way.

It is very stressful having your instructor in there and watching you so closely because you know, even if they say this is just a learning experience, but they are going to still see you make mistakes, they will remember what you did wrong. So they are still evaluating you. So that is always in your mind when you are going through it.

Similarly a professional nurse stated that:

I was really aware of my supervisor over in the corner. I feel like she was watching me and evaluating what I was doing. I wasn’t completely focused on it. My mind was still in the situation. But that was in the back of my mind all the time”
Most faculty participants recognized that students had a perception of being evaluated. Faculty also felt that this had a negative impact on the learning situation. One instructor stated that, “The teacher is always perceived as an evaluator. They can’t escape that. I think it is better if the teacher is just removed so that they can focus on the scenario more.” Another representative perception of faculty was this. I think the clinical instructor makes a difference. If they’re scared of their instructor that if they make a mistake that their instructor is going to evaluate them or be upset with them, it increases their stress level and alters their engagement in it. They are much more task oriented. They approach it more like a lab and are most concerned with showing the teacher what they can do. They don’t seem to involve themselves in the scenario.

The nature of the teacher-student relationship also impacted presence and the learning experience. Positive faculty-student relationships seemed to allay perceptions and fears of being evaluated; whereas, negative faculty-student relationships seemed to stimulate fear and anxiety interfering with engagement and attainment of endocentric presence. Both teachers and students described circumstances of impact from the nature of the faculty-student relationship.

An instructor that typically took the role of the mannequin operator described some of her observations here.

When you have a very authoritarian teacher, I think that makes students extremely nervous. I have seen students literally shaking and with terror in
their faces. They start fumbling and they are more concerned with how the teacher is judging what they are doing than engaging in the scenario. This is very counterproductive. They cannot learn that way.

I have also seen instructors that are more laid back but that have high expectations. I would say they play a supportive role when they facilitate. If they have a soothing, supportive presence in the simulation, then the students respond better. They are not paralyzed by the anxiety. Then they can focus and engage. They take the scenario seriously this way.

In this quote from a nursing student, she describes how a positive perception of her teacher seemed to assist her in a more endocentric state of being in the simulation.

Well, I knew the instructor was standing right there. I was a little bit concerned with my instructor evaluating me. But we had talked about this in conference. She just wanted us to try to evaluate ourselves knowing that one day it will be us out there. She made us feel how important performing safely would be, and how we need to evaluate ourselves, and should welcome someone else letting us know how we are doing. So really, her presence was not very noticeable to me. I just went into the simulation and did what I thought I should do.

The style of facilitation during the simulation was another instructional process factor that had bearing on presence. Jeffries and Rogers (2007) referred to this as the
collaboration between faculty and student during the simulation. They suggested that collaboration with mutual respect, comfortable exchange of information, high expectations, and constructive feedback would foster a positive impact on learning in simulation. Yet there is controversy in the discipline regarding what is considered best practice for the instructional process during implementation of a HF-HPS. The more often quoted recommendation is that teacher/facilitators remain more as outside observers to promote independent problem solving among participants in the simulation.

Data from this study would suggest that a supportive and embedded instructional process would promote an endocentric presence as well as a more positive learning experience in this situation where the purpose of the simulation is educational. The data would also suggest that the use of the outside observer and detached mode of facilitation leads to the perception of being evaluated by participants yielding greater anxiety and a more exocentric engagement. Here an instructor contrasted an embedded versus a detached instructional process in relation to the impact on the learning experience.

The instructor can be a distraction in the sense that if the instructor is standing back and not saying a word, they’re constantly glancing over at the instructor. It is like they are thinking, “I hope I’m doing this right,” and it makes the tension in the room almost palpable. This is compared to those instructors that are amazing. They come in with this type of approach. They say, “Let’s pause
where we need to pause and let’s think through this or that.” The entire experience is so much better when the instructor is actually in it. They [the participants] feel supported and then they can go right back into the situation.

Similarly, this faculty member described the impact on presence when a detached, observational, facilitation process was used.

When the instructor stands back and just lets someone sink or swim, I do not think it is benefitting the students very much. I have even seen the whole thing fall completely apart when the instructor does that. They completely disengage from it…I think they don’t feel like they have the resources that they would have to do the job. In the hospital, they would have different resources. So in a way, it is more realistic to provide some support when they don’t know what they are doing.

In contrast, this student described how a teacher accomplished facilitating in an embedded approach. The student recounted how an embedded type of assistance actually prevented an interruption in the scenario or a break in presence.

She just put herself inside the scenario when we really needed help. Like she jumped in as if she was the charge nurse as opposed to just watching us squirm. That really helped and it kept it all going like in a real situation. If you just have someone standing there outside the situation telling you what to do or yelling directions at you, that just takes you right out of the situation. You have to stop to deal with that; Then, it is just like a lecture in a class.
Similarly, this student described why an embedded instructional process increased the realism of the simulation.

It is less realistic that you don’t have dialogue going on with your instructor. Whereas in clinical, if you are giving a medicine or hanging blood, we are talking with the instructor, asking questions and double checking… That is how it really is. That would make it feel more real in the simulation. I don’t mean like teaching us and telling us everything to do. But more like coaching us as we go.

Jeffries and Rogers (2007) asserted the importance of the teacher’s role and the educational practices of the simulation. Likewise, in this study, both the nature of the student-teacher relationship and the instructional process were determinant of the presence in the simulation. Chickering and Gamson (1987) identified seven principles of good teaching practices. Among these are the need for faculty and student communication and a positive faculty and student relationship. Furthermore, best teaching practices are those that are supported by evidence as producing desired learning outcomes (Billings & Connors, 2009). Data from this study would support that a collaborative, respectful relationship and a communicative, embedded, instructional approach would effectuate increased engagement and an endocentric presence in simulation leading to potentially more positive learning outcomes in the context of an educationally based HF-HPS.
**Individual factors.** Individual factors are variations that reside within the unique characteristics or tendencies of participants and that may impact presence and ultimately learning outcomes related to simulation activities. Individuals may experience simulation differently in relation to psychological, social, physical, and other individual variations. There is a wide variety of traits that may differentiate learners and participants in simulation. While it has been often stated that no comprehensive theory of personality variables and learning has been established, much research and theory development exists around defining individual characteristics that may explain or predict learning. Characteristics such as motivation, attribution, and achievement styles (Dweck, 1986; Weiner, 1986; Bandura, 1977), cognitive styles (Brodzinsky, 1985, Messinck, 1994), learning styles (Sperry, 1977; Entwistle, 1988; Pask, 1988), thinking styles (Sternberg, 1994), coping styles (Lazarus & Folkman, 1984), and personality traits (Jung, 1921/1971; Eysenck & Eysenck, 1975; Myers & Myers, 1980; Costa & McCrae, 1992; McCrae & Costa, 1997, 1999) have been studied for their impact on behavior or learning.

By rational extension, participants may have variable learning experiences related to their individual differences that may also mediate on presence in a learning experience by simulation. Only preliminary research, as earlier presented in this report, has been conducted to identify individual factors that may impact learning and behavior in virtual learning environments (Kaber, Draper, & Usher, 2002). Yet, data from this study suggest that the individual differences presented in the model are among the determinants of presence in participants of HF-HPS. Individual factors
found to impact presence include: personality characteristics, emotional responses, referential experience and preconceptions, as well as entry competencies.

**Personality characteristics.** Personality characteristics are considered here to be intrinsic attributes that compose a primary disposition or tendency to determine patterns of thought, emotionality, and behavior (Furnham, Monsen, & Ahmetoglu, 2009; Boekaerts, 1996). Among the multitude of traits identified, there is a general assumption that a more limited configuration of attributes are more relevant personality characteristics that are thought to mediate on the learning situation. Costa and McCrae’s (1992) Five-Factor Model is widely noted. The model consists of the personality attributes of: extraversion, neuroticism, agreeableness, conscientiousness, and openness to experience or intellect. The interaction of personality attributes with the context of the learning situation is also recognized (Mischel, 1973; Boekaerts, 1996) where the individual’s perception of personal consequences in the situation may interact with primary traits of disposition invoking the behavioral response. Therefore, simulation as an artificial construction of reality may invoke other relevant personality characteristics that bear on presence. The personality characteristics of openness to experience, extraversion, and motivation emerged as attributes impacting presence in this study.

**Openness to experience.** The personality characteristic of openness to experience is considered to represent a cluster of traits leading to a tendency toward being open to the learning experience. These traits include the attributes of imagination, aesthetic sensitivity, attentiveness to inner feelings, intellectual curiosity,
and preference for variety (Costa & McCrae, 1992). Openness to experience here represents the participants’ tendency to relate and desire to participate in the simulation learning experience. Participants in HF-HPS demonstrated intrinsic tendencies to either be open to or resistant to the simulation experience. Tendencies to be open to the simulation seemed to effectuate endocentric presence; whereas, tendencies to be closed to simulation often resulted in resistance to participate and an exocentric presence.

Faculty participants in this study reported their observations and experiences with students having both open and resistant tendencies with the HF-HPS experience. One teacher described students that are closed and resistant to the experience in this way:

I have had some that just can’t get into it. They say they just don’t want to do the simulation. It affects them too when they have to do it. They are removed. They don’t participate much. They are withdrawn. It just seems to be something inherent in their personality.

Similarly this faculty described participant’s with closed tendencies:

Sometimes it is hard for students. They just don’t get the intention of it; so they choose not to involve themselves. They try to hang back from it and stay in the background unless they are forced into the simulation.

Students that were open to the simulation experience frequently described their imaginative, curious, or immersive tendencies. In their descriptions, the impact of
openness to effectuate endocentric presence is easily seen. This student described the influence of his imagination on the experience:

I have a very vivid imagination. I can really throw myself into pretend things. I mean, in part of the back of my mind, I know it is not a real thing. But because I can throw myself into it like I think it is supposed to be there, I just see it. It gets a little blurred sometimes really.

Another student said, “I just have a knack for treating it like it is real. I make it vivid in my own imagination.”

Other students described how their tendencies to be closed to the simulation situation impacted their learning experience. A self consciousness, low immersion, and exocentric presence is evident in their accounts of their experience. One student described how she “hates simulation” and how she refuses to interact in the pretend of it all. She stated that she coped with the situation by “just doing the skills and getting it over with.” Another student described her discomfort this way:

I don’t really relate to the mannequin or the situation. So it is very hard for me to interact in the simulation. I guess I just do it to the best of my ability. But I was very self conscious and uncomfortable. I was thinking more about what the other students were thinking than on what I was supposed to be thinking about the patient situation.

Likewise, this faculty member’s words affirm the intrinsic nature of being closed to the simulation and the impact on the experience. “I think there are some that are just
kind of flip about it. They just take the simulation as a joke. I think it is something in
the student themselves that they just won’t and just can’t pretend.”

In the virtual learning experience of simulation, openness to the experience is
also associated with the susceptibility to presence and immersive tendencies, an
element of presence. This susceptibility to presence in virtual learning contexts is
characterized by the openness attributes of imagination, concentration, attentiveness,
and self-control (Kaber et al., 2002; Psotka & Davison, 1993). This has also become
associated with the concept of willingness to suspend disbelief in the artificiality of the
simulation. Immersive tendencies are considered to be the cluster of attributes of
attention, focus, imagination, and distractibility (Witmer & Singer, 1998; Witmer et
al., 2005). Susceptibility to presence, willingness to suspend disbelief, and immersive
tendencies are considered here to be a related cluster of attributes that configure an
individual’s openness to the virtual or simulation experience in particular. As such,
these qualities also emerged in relation to the openness to the simulation experience
that impacted presence.

This student has a rather closed mindset to imagining the HF-HPS as real. A
low susceptibility to presence and unwillingness to suspend disbelief can be heard in
her words.

Honestly, I know everyone else said that they were very much like in the
moment with the simulation. But for me, it is not very real. I mean, I can’t –
it’s hard for me to get into it and talk to the patient like it is a person. I am
uncomfortable. I just can’t act in the situation like I am really doing something. I just don’t get that.

Likewise, this student described further how her unwillingness to suspend disbelief impacted her immersion in the simulation. She stated that, “I’ve never been a role-playing person. The anxiety it causes me, I just don’t because I can’t – like as they say, I just can’t immerse myself.”

Yet, in comparison, other participants described their willingness to suspend disbelief. This student described both her willingness to suspend disbelief as well as her immersive tendency. Her words also demonstrate her recognition of these characteristics as being individual tendencies among participants in simulations.

I want to come in here benefitting the most so I become immersed in here….I try to just act like this is perfectly real like in clinical and get as involved as possible. I feel like this is something that not everyone can do.

Extraversion. The characteristic of extraversion has become such a widely accepted personality attribute that the word itself nearly implies its meaning. Originating with the work of Jung (1921/1971) and Eysenck (1967), the term refers to a person’s degree of energy from which is derived a degree of being outgoing and interactive with others. In common use, extraversion refers also to a person that is energetic, positive, and one with a tendency to seek gratification outside oneself. At the other end of the continuum is the characteristic of introversion that implies the opposite tendencies. It is generally accepted that individuals have attributes on a
continuum between these polarities as a dimension of personality.

Extraversion as an individual difference that may moderate immersion and susceptibility to presence in virtual environments has not been much considered. However HF-HPS, an augmented virtuality, requires of the participant to role-play. To the degree that an individual’s comfort level with enacting a role in simulation is likely related to their degree of extraversion, then this attribute could be at work in HF-HPS. In this study, the degree of extraversion as a personality trait seemed to be a relatively strong determinant of presence in HF-HPS. However, the impact on presence associated with the degree of extraversion had an inconsistent impact on presence in this type of simulation.

Most faculty participants described how extroverted students generally immersed more easily in simulation. They also seemed to indicate a tendency toward endocentric presence associated with extroverted personality types. This is one faculty participant’s description:

I think personality plays a factor in it. I think people that are more assertive, more self confident, more outgoing, or more extroverted are definitely more comfortable in acting and role playing. Sim requires some acting; so the students that are more introverted, shy, quiet - we’re asking them to perform in front of us and their peers; and, I think it is hard for them to engage in it because of their inhibition and introvertedness.
Another faculty member described the negative impact on presence and the learning experience in simulation of students with tendencies toward more introversion.

We need to think of how to work with different personalities in simulation….I have seen it happen when you put a shy person in a primary role - they come completely unglued. Sometimes they just completely disengage and pass on it. Or they just can’t function in it. So then I ask, “What are they learning from that?”

In comparison, this student recounted a more endocentric presence and a positive learning impact from her basic extroverted nature.

Yeh know, I am rather outgoing and I have a vivid imagination. So I kinda fall into this type of thing pretty easy. I like acting and stuff. So I can kinda just put myself there like it is real and go with it. I think you get more out of it that way too.

While extraversion has been shown to be positively related to immersive tendency in one study of personality traits related to immersion in mediated environments (Weibel, Wissmath, & Mast, 2010), the impact on presence showed some inconsistency in this study. In most cases, as shown in the former examples, extraversion had a positive impact on presence and the learning experience; however, there were some exceptions where high degrees of extraversion actually promoted a
rather artificial presence centricity. This was described by one faculty participant in the following excerpt.

Some of your overly out going people just take it as a big joke. They come in and over act like they are playing in some big theatrical part. So you really need to dial it back with them. When they are overacting like that, they don’t make a personal connection with the patient or their peers in the simulation. They aren’t really focused or engaged and need to be prompted on the problem in order to get them to lose that pretense and start to focus and engage and treat it more real.

**Motivation.** Motivation is an often cited personality characteristic that is thought to impact learning and behavior. Motivation is considered to be one’s willingness to take action. In the learning situation, motivation is related to what the learner perceives as an expectation of themselves or others (Bastable, 2008). Motivation is also considered to be a factor of emotional readiness to learn (Bastable, 2008) and an important educational and instructional design consideration (Morrison et al., 2007).

Motivation emerged in this study as a personality trait having some impact on presence. This was a representative comment from a faculty member regarding the negative impact of low motivation on presence and the learning experience in HF-HPS.
Sometimes it is a motivation thing. They think, “I’m never going to learn this. I’ll never need this because this isn’t what I’m going to do in nursing when I am done with school.” So they are kind of dismissive about it. So it is like they resist themselves and don’t allow themselves to become immersed or very engaged in it. It definitely affects whether or not and how they engage in the simulation.

Similarly, a student participant put it more bluntly when she stated,

Not everybody has the intrinsic motivation. So, some people completely half ass it. So when they tell you that it is just a learning experience and not graded, they don’t come prepared for it and they just blow it off whatever happens in the simulation. That ruins it for others that are here to learn something.

In comparison, another student recounted how high motivation impacted presence and a positive learning outcome. “I really want to make it real and do the things I was responsible to do. I felt like this was happening. Patients can be unstable like that. It was real life to me today, really.”

**Referential experience and preconceptions.** Referential experience and preconceptions refer to individual differences in prior experience or anticipations and expectations that the learner will likely draw upon during the simulation learning experience. Nursing students may draw upon previous lab or clinical experience; professional nurse participants may draw upon previous clinical practice experience.
Additionally both groups may enter the simulation experience with a preconception of what will unfold in the clinical scenario based on clues from preparatory assignments/experiences, the stated purpose of the objectives of the simulation, or even by word of mouth from participants having already completed the simulation and shared their experience with the participants entering the experience.

Both referential experience and preconceptions may mediate on the learning experience. Kaber, Draper, and Usher (2002) suggested that the level of experience that users bring from the real environment that serves as comparative subject matter for virtual experiences may have a significant impact on user performance in the simulation environment. Related prior experience may impact the participants’ acceptance of the simulation as a “surrogate to real tasks” (Kaber et al., 2002, p. 382). Individual differences in conceptualizations from referential experiences may affect performance in simulation “to the extent of influence by the [participants’] expectations of consistency between the real and the [simulated form]” (Kaber et al., 2002, p. 382) of the clinical scenario. Similarly, preconceptions may also mediate on the simulation experience to the degree that participants may anticipate the clinical problem in the scenario. Interview results from this study indicate that both referential experience and preconceptions may strongly mediate on presence and on the learning experience in HF-HPS in different ways.

In the sample of nursing students, preconception was the primary entry factor. Preconceptions regarding the clinical scenario seemed to lead to over attention to selected cues, altered cue recognition, and altered clinical reasoning. Students seemed
to be in waiting for the anticipated clinical event to happen. The over-attention to the anticipated data seemed to obscure from recognition other clinical data presenting in the scenario. Observations of this response also indicated that students came to what has been termed “premature closure” (Turkle, 2009) on the data rather than utilization of the expected processes of cue clustering and differential logic of clinical reasoning.

Here one faculty member described the impact of preconceptions on presence and on clinical reasoning in the simulation.

If someone in the first group tells what is going to happen, then they are anticipating and predicting what will happen. So they are not really engaged. They take it like a bunch of skills to do. It is not like real to them when they wouldn’t know what will happen and they would have to figure out what is going on.

Similarly, this teacher described the impact on reasoning this way. “They don’t get much out of it if they don’t have the opportunity to discover. They have to have the opportunity to engage in the scenario and to reason their way through it.” Another teacher described the premature closure on data that occurred from preconceptions on entry to clinical simulation. “We’ve identified…if they are cued into what the simulation is before they get there, they approach it very differently. They kind of jump phases and skip phases or parts of the process.”

The responses of students and of practicing nurses lend some insight into how preconception and anticipation alter presence and clinical reasoning in the simulation. One student said:
Well, I knew it was gonna be a code before I went in there. So beforehand, I was kinda rehearsing what I would do. I was thinking I am gonna go in there and ask if he is having chest pain, sit him up, and put oxygen on him and see how it goes from there.

From this is seen a closure on data prior to entry into the simulation and an exocentric, task oriented approach to the simulation scenario.

A professional nurse participant similarly stated it this way. “I was just waiting for it and anticipating. I was thinking, like, when is it going to happen? So you are just looking at his [oxygen sats], watching and waiting for him to code. But at first he was okay, talking.” Her words indicate a closure on symptoms to the exclusion of presenting data and an exocentric presence on the outside of the situation just waiting and watching.

Similarly, this nurse described how preconception altered her cue recognition, differential clinical reasoning, and intervention.

See from my clinical experience, I would normally go in and assess the patient. I wouldn’t know ahead of time what they were gonna complain about. So I would be asking a series of questions. I wouldn’t assume that just cause he said he had discomfort that it was a heart attack. I might have been thinking first that it was just heartburn. But here [in the simulation] I was just immediately ready to go get the crash cart on his first symptom. It would never have been like that kind of automatic response in the real situation.
The mediation of referential experience also emerged and manifested itself in variable ways in both student nurses and the comparative group of practicing nurses. Student nurses achieved a more endocentric presence associated with advancement in their nursing curriculum and with greater exposure to simulation learning experiences. However, as might be anticipated, the impact of referential experience was more pronounced in professional nurses who had more real clinical experience to draw upon. The impact on presence in practicing nurses seemed to vary in association with the participants’ estimation of the congruity of the simulation experience with the real clinical experience. Incongruity of processes or low realism factors were strong negative mediators on presence and the learning experience resulting in a sense of disorientation in the situation, resistance to participation, and even responses of frustration and deflated confidence levels.

The positive impact of referential experience on presence and on the learning experience in nursing students is evident in this faculty member’s comment. She stated, “When they have similar experience in clinical, I think that they recall it and draw on what they have learned. It helps them engage and perform in the simulation environment.” Another faculty member also explained how progression in the nursing curriculum and experience with simulation increases an endocentric nature of presence.

I think it [referring to presence] depends on what level they are in the curriculum. If they are sophomores, some just stand back laughing at it. You know, they haven’t been there yet in the real situation…. So to them it is just a
mannequin. Then, when they are junior or seniors, they are much more serious and into it. I think their experience in the hospital makes them know that things are going to be demanded of them so they want to make the simulation real…. So their engagement in the simulation increases.

The more pronounced impact of referential experience is heard in this faculty member’s description of her observations of professional nurses participating in simulation. Difficulty accepting simulation as a substitute for the real is evident here.

Because staff nurses have more experience, I think they are more confident in going about things in the simulation. But I think that it affects them in other ways. Like they are more sensitive to differences in equipment and processes that are different. They have a harder time with the suspension of disbelief toward the mannequin. I have seen them question whether they are supposed to do things in the simulation for real….they appear to be less immersed…I think some are even opposed to it inside. I don’t know, but I think they have some defensiveness too. It is a little bit of lashing out against having to do the simulation.

This staff nurse as quoted in part earlier described her feeling of disorientation in the simulation. The impact of referential experience is clear where this nurse’s expectations of congruity with the real were unmet in the simulation; she described the impact on her cue recognition, clinical reasoning, and performance as well as the deflation of her confidence level.
This was nothing like real. I was so disoriented. I didn’t have the same processes that I usually go by on the unit when I am assessing my patients. See, I usually have more information before I go into the room. I look things up and write things down on my own worksheet in a certain way to trigger me when I go in the room to assess my patient….Plus, I usually take supplies and equipment in the room and that triggers me to ask certain questions and to do certain things. This had so many different processes; and I didn’t know how to get the supplies I needed. Nothing was labeled properly. I was so flustered. I am sure that is how I gave that medication error in the simulation. I was so tense and anxious. The whole experience made me lose confidence in myself.

Yet, when the content and processes of the clinical situation in the simulation were congruent with the expectations of participants compared to prior referential, real clinical experiences, an endocentric presence and more positive learning outcome was evident. One participant reported that since she had hung blood before in clinical, she thought, “it made it more real if you have done the tasks that are in the simulation before.” She went on to explain that “if you have had some previous experience, you can be focusing on the simulation and be thinking through how to handle the situation.” Similarly, another participant stated that since she had seen a code before that she knew what to expect. Her words explain how the referential experience enabled presence in the simulation. “It was easy to put myself back in the real situation since I had seen something like it before.”
**Emotional response.** Dynamic, scenario based HF-HPS is a stressful learning experience. An overwhelming majority (90%) of participants in the simulations observed reported feelings of stress and anxiety prior to and during the learning experience. The anxiety seemed related to the perception of being evaluated or watched whether or not evaluation was a stated purpose or objective of the simulation. The anxiety manifested itself in two ways. In most cases, the anxiety was performance anxiety associated with the discomfort of being watched by instructors, managers, facilitators, and/or peers. In other cases, the anxiety was stimulated by the urgency of the patient situation as would be anticipated in a similar, real patient situation. The impact of anxiety on presence in the simulation seemed also related to the stimulus of the emotion. In general, performance anxiety led to bicentric presence where participants maintained higher degrees of exocentricity due to a continuous awareness of being observed in the situation. Yet, anxiety stimulated by the urgency of the simulated patient situation, led to more endocentric presence. This seemed productive to the learning situation as it resembled emotions that would occur in real situations of urgency.

Participants that felt performance anxiety indicated that they were uncomfortable performing in front of both teachers and peers. The feeling of being watched remained throughout the experience and seemed to impact presence and performance. This student described how anxiety impacted her engagement in the simulation.
It was a high stress situation. I was very nervous…I didn’t want to be engaged in it because I didn’t want to do or say the wrong thing. I was outside of the situation totally. I was more worried about being wrong than being part of the simulation.

This student further described how the anxiety impacted the cognitive dimension of her presence in the simulation.

This puts you in a situation where you have to perform in front of everyone, your teachers, your peers, and everything. My mind just goes blank and then I completely can’t recall anything. I am not shy. My roommate and I, we really studied for this. We knew all this stuff for the simulation today. I just couldn’t recall it in the situation feeling like everyone was watching me.

Even when students knew that they were not being evaluated in the simulation and that the objective for the simulation was to provide a safe learning environment, students still perceived performance anxiety. This performance anxiety led to bicentricity and in some cases to complete exocentric presence.

In the situation where students felt fear and anxiety related to the urgency of the patient situation, this tended to heighten awareness. Participants reported this type of anxiety as more productive in the learning experience. The heightened awareness also enabled a more endocentric presence as this student described. “I was so focused on all that was happening to her, I didn’t feel like anybody was even in the room.”
Similarly this student described how anxiety helped her see how she might act in a real situation. “Yes, there was a lot of stress and anxiety, but that is how it is gonna be in a real code. This helped me focus more and see how I was gonna handle it.”

Faculty also perceived that some amount of anxiety in the simulation situation was productive. One teacher rationalized the anxiety in the HF-HPS learning situation this way:

Yes, we see a lot of anxiety in simulation. But there is a lot of fear and anxiety in a real code situation. So, I am not sure if that is, on some level, OK. We need to use this to teach them [nursing students] how to manage their own anxiety in a critical situation - make it work for them.

Managers and nursing educators related to professional nursing education also felt that there was a purpose to anxiety in the learning situation with HF-HPS. One manager stated, “In sim, they can really see what they are gonna do in a critical situation and how their anxiety will affect them.” In some ways, managers and nurse educators were almost dismissive about participants’ performance anxiety. This dismissiveness seemed motivated by a concern for the responsibility of the nurse for competency in professional practice. A clinical nurse specialist put it this way.

You know, everybody is slightly anxious in simulation. A lot of people think, then, that evaluation simulations are counter-productive because of anxiety. But I struggle with this idea. As professionals we have to know how we will
perform under pressure. As professionals we have to accept that we need to be evaluated. It is part of my responsibility on this unit to make sure everyone is competent in their practice. Maybe that is too bluntly stated? But that is just the truth of it.

The anxiety pattern in this study seemed to reflect long established patterns identified in psychology and learning theory. Anxiety has been identified as a factor influencing cognitive, affective, and psychomotor functioning (Bastable, 2008). It is generally accepted that lower levels of anxiety may increase readiness to learn and raise attention and arousal levels enhancing learning; whereas, high levels of anxiety may hinder concentration, retention, and task performance (Bastable, 2008).

Recalling the Yerkes-Dodson (1998) curve, the potential for learning is enhanced up to a peak level of anxiety at which point arousal and performance are likely to decrease in an inverse U-shaped pattern where anxiety hinders learning. In this study, participants that perceived high degrees of performance anxiety experienced exocentric presence with impaired focus, cognition, and performance. Consistent with Yerkes-Dodson (1998) curve, participants feeling stress related to the urgency of the care situation seemed to experience levels of anxiety that heightened awareness and enhanced task accomplishment. While faculty and some students recognized the potential benefit of low to moderate anxiety in the simulation learning situation, the majority of participants in the study experienced unproductive levels of anxiety.
**Entry competencies.** Entry competencies are the prerequisite knowledge, skills, or attitudes that learners must have in order to more fully benefit from learning activities (Morrison et al., 2007). In relation to a dynamic, scenario based HF-HPS, a working knowledge of the clinical problem as well as a basic competency in the clinical skills or interventions required to manage the problem presented in the scenario are necessary to increase the likelihood that participants would benefit from the experience. In this study, both cognitive factors and task competencies emerged as determinants of presence in HF-HPS.

Prior to the simulation, students received a preparation activity that prompted the student through the prerequisite knowledge related to the clinical problem. Earlier in the term, students also attended a standard clinical skills lab to learn and practice the major skill that would be encountered in the simulation. However, there was also an expectation that students would come to the simulation with other accumulated knowledge and skill competencies from class, lab, and/or clinical experiences that they would have had exposure to earlier in the curriculum. Thus, not all skills required in the simulation were reviewed or taught prior to the simulation. The comparative group of practicing nurses also received a preparatory assignment to read two articles related to the clinical management of the problem that would be encountered in the scenario. Skill competencies were expected of these nurses and were being evaluated in the simulation. Yet, not all the nurses necessarily reported having had prior experience with the clinical problem and/or with one or more of the skills required for management of the problem.
Student participants displayed varying levels of competencies despite having preparatory or prior experience. Faculty interviewed for this study recounted their observation that students without requisite knowledge or skill competencies had difficulty with presence and clinical agency. One teacher stated, “They have to have the knowledge and the skills under their belt before we can expect them to be present in what is supposed to be a simulated, real situation. Otherwise, they just stand there and watch.” Another faculty participant expressed it this way: “From my experience, definitely stronger students are more able to connect with and carry out a role in the sim.” This faculty member also referred to the impact of entry competencies on the learning objectives and the learning experience.

I think that sometimes it is about the skill level of the students. They lose the big picture of what the goals for the sim are and they can’t engage properly since half of it is just flying by them and they are completely unaware of it. I have even found myself pulling some of the skills out because this is such a definite problem when there is a mismatch of competency [between the learner and the simulation].

When students lacked or could not retrieve essential knowledge, they reported the impact on presence in terms of being frozen and unable to act. One student stated: “We didn’t’ know what was happening. I think that is why we all seemed kind of frozen. At times we were all just like, we don’t know.” Another student spoke of how she was unable to retrieve what she knew from the preparation. “I did not know what
I was doing. I just froze. I knew what to do; but in that moment, I went blank. That scares me. Everything, I know, it was gone.” This student also described the impact on the learning experience of not having essential knowledge and skills.

I wasn’t sure what to do. So, I just kind of stood there, like, I don’t know what the right action is. I didn’t know all the meds. I kind of knew the process; but, I didn’t remember the order of all the steps. I got frustrated because I really didn’t know. So personally I felt incompetent and I was just standing there like I was on the outside of it all.

In contrast, students that had requisite entry competencies demonstrated an endocentric presence with high levels of clinical agency. A faculty participant reported on how her group “was very engaged because they were so knowledgeable and skilled.” Another student’s comment reflected how his preparation positively impacted his focus and prevented distraction.

I really prepared for this. So I was really able to just focus. First I focused on the assessment and I didn’t get distracted by anything. Even when the patient was getting upset, I didn’t let it get me overly emotional about it. I stayed focused on the problem and the priorities. I knew if I got that taken care of, then the patient would calm down. My whole focus and priority was to make sure to get her stable again. I knew what I had to do and I just did it.
Similarly another student described it this way.

I knew from our preparation what the problem would be about. So, I had to just reason. I felt like I was kind of problem solving trying to figure out what was wrong. I felt like I was actually in a real critical situation that needed to be solved.

In comparison, the professional staff nurses similarly exhibited the impact of entry level competencies on presence in the simulation. One nurse stated that she felt the simulation was, “overall…a test of your skills.” She went on to say, “I think my performance reflected my skills. So I felt very involved and responsible for the outcome.” Another nurse described how she had a lot of experience with codes from her work in a float pool. So she stated that:

I knew what would probably be happening to the patient. So during the simulation I was most concerned about trying to recognize the issues. For a while, I almost even forgot it was a dummy. I was really into it. I was just trying to focus on what I needed to do and to get done.

The professional nurses also recounted the negative impact on presence and the learning experience when others in group did not have requisite competencies. Here, variable competence in the group seemed to pull participants’ presence outside the simulation into a bicentric or fully exocentric presence where their concern was focused on frustration with the cognitive or skill levels of others in the simulation
group. These statements from professional nurse participants exhibit the impact on presence and the frustration that ensued when entry competency was lacking. One participant stated, “I really get frustrated with people that do not have my own skill set. It is very stressful to be trying to help the patient in the simulation and somebody doesn’t know how to do something.” Similarly another nurse described it this way.

There was a time in the simulation where it was just me and the other girl. I felt like she was moving slow, didn’t see things and didn’t know how to do things. I wanted her to get in the game here. I kept thinking, “come on, get into this!” This was real to me at the time. So it was really distracting to be thinking whether she was gonna wake up and get into it. And how do you handle that when you know that you are both being evaluated. I knew what I was doing.

**Group factors.** A dynamic, scenario based HF-HPS is a group learning activity that requires learners to participate in a role play enactment aimed at managing the clinical situation represented in the simulation. Participants, then, are called upon to function in a group and to conceptualize and perform an unscripted improvisation of professional, interpersonal, and inter/intraprofessional roles and behaviors in response to the unfolding clinical situation. As such, in this study, group factors such as dynamics and structure emerged as determinants of presence.
**Dynamics.** Group dynamics refer generally to the interaction and influence of group members. As originally defined by Lewin (1947), group dynamics are considered to be the manner in which individuals and groups act and react to changing situations. Some aspects of group dynamics include roles/relationships, cohesion, communication/coordination, patterns of influence, plans/goals, and effectiveness (Forsyth, 2010). Presence of participants in HF-HPS seemed impacted by the group dynamics of cohesion, goals, and coordination.

In this study, participants were assigned or self selected into groups for participation in the simulation scenario. In the case of the primary sample of student nurses, the groups for the simulation were comprised of the same membership as the groups that students were already participating in for their clinical experience in the course. In the comparison sample of second degree, prelicensure, nursing students, the participants self-selected their group assignments and generally selected into groups where they were also familiar with the other members. In the group of professional nurses, the participants were assigned to groups. Generally the members of the professional nurse group as well as the student groups had some level of familiarity with each other through their work or clinical experience.

Cohesion is considered to be a group factor leading to unity and the development of a shared climate, identity, and commitment (Forsyth, 2010). Participants in the simulation groups having familiarity with one another, seemed to have trust, comfort, and cohesion. The dynamics of comfort and cohesion increased
engagement and enabled the group to function as a team. One faculty member put it this way: “The dynamics of the group - that really makes a difference in the immersive presence of the whole group. It’s their comfort with each other and their level of trust that makes the big difference.”

Similarly this student described how group cohesion and goals influenced their focus, engagement, and coordination in the simulation.

We have the best group. We all know each other really well because we have been in the same clinical group together. I felt we were a really good team. We all had the same focus; and we were all working towards the same goal. Everyone was in it trying to help each other know what to do next. Everyone jumped right in with what they knew. We all wanted to show them what we can do.

In contrast, this nurse described the negative impact of the group dynamic when members were unfamiliar and cohesion was lacking.

It is stressful being in a group that you don’t normally work with. You don’t know how the other person works or how they like to do things. It makes it very hard to be a real team in the simulation. Instead you are just feeling uncomfortable. Then it is harder to get into it, you know?
**Structure.** Group structure concerns the organization and relation among members that organize the group. Structure also concerns the “underlying pattern of roles, norms and relations” (Forsyth, 2010, p. 9) among group members. These structural aspects link and interconnect group members in ways that can enable interactions and behaviors that focus the group on plans and goals to generate an outcome. The structural elements of group size and role seemed to have impact on presence among participants in this study.

**Group Size.** Group size influences the nature of groups in a variety of ways (Forsyth, 2010). Group size ranged from three to eight participants in this study. When group size was between three and four members, all participants had active roles in the simulation and were assigned to nursing type roles. Members were more interconnected and functioned more as a team. Participants had higher levels of communication and interdependence. Groups of this size also more often used a problem solving process by consensus. This connected structure helped to increase engagement in the simulation, minimized distractions, and led to more endocentric presence.

In contrast, when group size was seven to eight members, the group size exceeded the available opportunity for active role-taking. Four of the eight participants were assigned to observer or back-up roles. Participation by observation may still allow for different types of learning; however, observational roles preclude active engagement in clinical reasoning, problem solving, clinical judgment, or intervention. Thus a large group size necessitating learner participation in
observational roles induced an exocentric presence in the simulation by way of the
group role structure. Furthermore, the presence of group members with active roles in
the simulation was similarly impacted due to increased performance anxiety that was
provoked by having an audience of peers in the simulation.

The impact of group size on presence in simulation was evident in 100% of the
faculty interviews. This faculty member described the difficulty with structure when
group size was too large for the simulation. She stated, “We have found that when it
goes beyond 4-6 that there are not enough roles to involve everyone…then students
are just standing in the background.” Another teacher stated: “Small groups are
essential. Having eight is terrible…it is a waste of time because they don’t get to do
anything and they don’t engage in it…they’re kind of focused on what’s going on
outside the situation.” This faculty member also recounted the problematic when
group size is too small. “If you have groups too small, then students are more
concerned with feeling on the spot. They get really self-conscious in the situation and
lose their focus in the simulation.”

Students also recounted how large group size increased their sense of
performance anxiety. This student explained: “I really think it is better with just four
people. When there are more people, then people stand in the background and you
feel like more people are just watching you. Then it is so hard to focus.” When
talking about group size another student also described how it impacted her
engagement:
I felt more outside of it because I was assigned to be in the observer role. So I just didn’t take it all that seriously since you are not really that involved. I was just watching it for the check off sheet to see if they were doing all the requirements.

*Role factors.* Dynamic scenario based HF-HPS requires participants to engage in a role-play enactment. Ideally the role taken in an educational simulation would be the role for which the student is in training or for which the professional already occupies. HF-HPS also includes supportive or facilitating roles that enable the scenario to unfold and aid in the fidelity of the simulation to the real patient care situation. Role has been defined as a social position and the behaviors or expectations of behavior in a context-specific situation (Hindin, 2007). Role playing then requires participants in simulation to play the part as they perceive the role would be enacted in the reality of the patient care situation. The degree to which participants perceived that they were able to perform the expectations of a given role and the congruity of role status in the simulation with reality seemed to have strong impact on presence in this study.

Roles for the simulations in this study were most typically assigned by the faculty for the simulation. Assignments were either purposefully designed to address learning objectives, competency levels, or group dynamics. On some occasions roles were arbitrarily assigned by a drawing of names for roles or by volunteer. Roles included: primary nurse, secondary nurse, charge nurse, documenting nurse,
medication nurse, patient care assistant, or family member. Faculty members typically took the role of the prescriber. Additionally, faculty members or technicians operating the mannequin were usually in the role of the voice of the patient/mannequin in the simulation. Presence was negatively impacted in this study when students perceived issues of role ambiguity (Kahn, Wolfe, Quinn, Snoek, & Rosenthal, 1964), interrole/intrarole conflict (Forsyth, 2010), and role expectations (Berger, Ridgeway & Zelditch, 2002) with their own role assignment or with roles of others in the simulation. Endocentric presence was enabled when participants perceived role congruity.

Students perceived role ambiguity when they were assigned to a role for which they were unfamiliar or had no previous exposure or experience with. Role ambiguity refers to the situation when the expectations, responsibilities, or activities of a role are unknown, unclear or ill-defined to the role takers or the role senders. Role ambiguity causes the occupant of a role to question their own abilities to fulfill the role and leads to role stress (Forsyth, 2010). In the case of role play in the simulations in this study, role ambiguity seemed to cause participants to also stand on the outside of the situation watching and waiting to see their position and to be given their role expectations from others. This engendered a more exocentric presence.

Faculty participants in this study described that when students were assigned to the role of a charge nurse for which they had little referential experience, that they often were confused and stressed in the situation due to lack of understanding of the responsibilities of the role. Faculty also indicated that students had difficulty engaging
in the simulation without identification with the role expectations. One faculty member stated, “I think identification with the role is a big factor [relating to presence]. If they don’t know what a charge nurse really does, then that is just too abstract for them. Then they have a hard time with engagement.” Another teacher described the impact of role ambiguity and the resultant impact on presence and role performance.

I think it is horribly confusing for them if they are put in a role that they are unfamiliar with…They don’t have a clue on that. They feel so on the spot. They are supposed to be leading their team and they don’t understand the role or have the experience to be the expert nurse. So they just stand on the outside of it and wait for something to happen.

Students affirmed this role ambiguity when they were assigned to the charge nurse role in the simulation. They described how such role ambiguity decreased the realism and led to presence on the outside of scenario, an exocentric state of being in the simulation. This quote from a nursing student describes the impact of role ambiguity on her experience in the simulation and on the experience of others.

I was supposed to be the leader. I didn’t realize what I was supposed to do the entire time. I didn’t know how to do everything so I didn’t feel comfortable assigning other people things to do. It didn’t work very well. Nobody knew their part when everything started happening to the patient. We all just stood their looking at each other, like: “What do we do now?” I didn’t know. Then
the teacher had to take over and had to tell everyone what to do. So that made it much less real. It’s like we stood back and didn’t put ourselves in the situation. We just let the teacher tell us what to do.

Similarly a representative comment from the comparative group of second degree prelicensure students reflects how role ambiguity impedes an endocentric presence.

I was put in the role of a charge nurse. I was so confused because I’ve never been a charge nurse or seen what a charge nurse does. I would have been much more into the simulation if I could have been the primary nurse because I would have known what was expected.

Role ambiguity did not emerge as a theme in the comparative group of professional nurses. Professional nurses have experience in charge nurse roles and more experience as members of the health care team. Therefore, it is consistent with role theory that perceptions of role ambiguity did not occur in this comparative sample in this study.

Another salient issue of role that impacted presence among participants in HF-HPS in this study was intrarole conflict. Intrarole conflict occurs when there are inconsistent or contradictory demands or expectations within a single role (Merton, 1957; Forsyth, 2010). There were two different situations that led to intrarole conflict among participants in this study. When students were placed in roles of which they were familiar, but were subordinate to the role of the nurse for which they were being
educated to assume, this led to intrarole conflict. Groups in the health care system exist in a network of groups having superordinate roles and responsibilities. When participants were placed in situations of acting outside the role hierarchy or when expected roles in the organizational network were lacking, this also led to intrarole conflict.

Often based in group size and the need to include participants in roles in the simulation, students were assigned to the patient care assistant (PCA) role instead of a nursing role. Here the role expectations were custodial in comparison to the role of the nurse. Students found themselves in conflict if assigned to role play a PCA and then were also called upon to participate in nursing care responsibilities in the simulation. They also found themselves in conflict when they felt the need to contribute to the clinical reasoning of the group when this would have been outside the role expectations of the PCA. Students perceived this as diminishing their engagement in the simulation and as diminishing their learning experience.

Faculty participants often identified this type of role conflict in their interviews. This faculty member put it this way:

Putting them in the role of a PAC is not very good. They are here to be learning the nursing role. So we put them in a PCA role and then they end of doing some of the nursing tasks that they would not be allowed to do as a PCA. This is a role conflict for them. We shouldn’t be putting them in that position.
Another faculty member stated that

Putting them in the PCA role is really not any benefit to the student. They are in sort of a role conflict with that. They are supposed to be thinking and doing like a nurse in the simulation, but acting in the role of a PCA? There is something not congruent there.

This student, as others also did, described how the role conflict related to being assigned to the role of a PCA caused her to move into an exocentric presence since she would not have been allowed to perform the tasks of the nurse in the simulation.

I saw myself a little differently than the others. I wasn’t actually in the situation cause I was assigned just to be the PCA. So I just kind of had to stand back and kind of just watch things happen. I was like being on the outside of the team.

The second type of intrarole conflict that was salient among participants occurred when they perceived that the normal network or hierarchy of roles was lacking in the simulation. This was perceived in several circumstances of the simulations observed. Students felt a conflict in role expectations when they were functioning in a group of inexperienced peers without the resource of an experienced nurse or team member to draw upon for consultation. This often led to frustration and even to students becoming frozen in the moment. Students further expressed role conflict when they felt that they were made to perform outside and beyond the role
expectations of the nurse if the role of a prescriber nurse or physician was lacking. Both students and the comparison group of professional nurses also expressed conflict of intrarole expectations when they perceived that the support network of an emergency response team was lacking in the simulation as it would normally be available in the real health care situation.

This student expressed the conflict in role expectations that she experienced being in a group of her peers in the simulation.

I think it is unnatural and unrealistic how they do it. If we were in a similar real situation and anything happened, a more experienced nurse would jump right in and help….They wouldn’t ever let a bunch of novice nurses who’ve never seen this before just deal with it with a patient. So this just makes you feel like we are just students in a lab not like we are in a real situation.

Similarly, this student expressed her role conflict concerning the issue of patient safety and being made to perform a task for which she was not able to seek guidance in performing. This role conflict prevented her from feeling present in a real situation.

I didn’t feel like I was in a real situation at all. We definitely would have had superiors to seek information from, ask questions, and get validation from…I never would be doing something to a patient where I wasn’t sure what I was doing. That just isn’t safe. And you certainly would not ask your peers who didn’t know any more than you do. So I think in the simulation that you
should have people in those roles so that you are acting in a real team atmosphere.

The comparison group of professional nurses expressed a similar role conflict but at a more meso level in the network of roles. For them intrarole conflict occurred when the role expectations in the simulation exceeded the reality of the role expectations that would occur in the real clinical care situation. This nurse described the impact on presence related to lacking access to the hierarchy of roles in the simulation.

You just couldn’t take it seriously and get engaged because it was so out of the normal. Normally on the floor you would have a mix of people and experience levels that you draw from. So even if you could have, you couldn’t make believe in the simulation.

Similarly, this nurse described the role conflict when the access to the normal role network of the emergency response team (ERT) was lacking in the simulation.

In reality we would have called an ERT when the patient started going downhill. There would have been someone come in and take charge of the team. There would also have been very knowledgeable and experienced people around making sure everything was done right. It was just nerve-wracking in the simulation. I was very hesitant to be involved or to take a role. I just felt like a student all over again.
Role expectations at times were a distraction to presence among participants observed and interviewed in this study. HF-HPS requires an embodied role play enactment among the group of participants. Participants, then, have role expectations of other actor participants in the group. In this study, when actors enacted their role congruent with expectations, endocentric presence was enhanced. Conversely when actors played their role incongruent with expectations of that role, presence in the scenario was impeded. This teacher explained the impact of role play expectations this way:

I think identification with the role is a key factor to immersion and presence in a simulation. Students need to be able to identify who is in a role and they need to be able to identify with the responsibilities of the role that they are in. And for everyone to stay immersed, everyone really needs to stay in their roles.

Situations where participants were overacting their roles were observed in the simulations. In some scenarios, teacher/facilitators overacted the role of the prescriber and presented the role in an unprofessional and stereotypical fashion. Students were often taken by surprise when the expectations of a professional role presentation were met instead with a comical or sarcastic role presentation. Facilitators overacting in role play decreased the realism often causing breaks in presence moving students from endocentric to exocentric presence in the scenario. This manifested itself as a distraction from the simulation and was evidenced by students breaking into laughter or commenting to one another in their student role persona.
Another situation of overacting often was observed when students were assigned to the role of a family member in the simulation. In the simulations observed, the family member role was unscripted. This often led to overacting and distracting the participants away from the primary clinical situation in the scenario. Faculty members interviewed often cited the problem with unscripted roles and the impact on presence in the simulation as in this next passage.

I think having a student in the role of a family member is very distracting. They can get the group way off base sometimes when they overact and overdo their role too much. I think that family member roles should be scripted. This has a lot of impact on increasing their [participants'] engagement in the simulation.

Role overlap presented another situation of incongruous role expectations that impacted presence in simulations. Due to staffing limitations, at times, faculty facilitators had to fulfill multiple roles in the simulation. For example, a teacher may have been simultaneously acting in one or more of the roles of the teacher, the doctor/prescriber, the lab technician, and/or the mannequin operator. This role overlap was typically a distraction to presence in simulation. The next teacher described the nature of this distraction.

Roles are a very big factor. If you have a teacher for the class who is their teacher, plus they are playing the doctor, and the lab person, it really detracts
from the reality of it all. It becomes very confusing and disorienting to them. They don’t know who you are and they have to clarify that. To do that, they have to come out of their role.

Similarly another teacher explained: “…role overlap is a big problem. If they don’t have a clue who the person is supposed to be and have to ask, it is not realistic. So their frustration rises and they break out because the roles are all wrong.

Issues of role were of salient impact on presence in simulation. This registered nurse so aptly summed the impact of role on presence in simulation.

Having a role really forced me into it. I mean, you know, the whole thing about simulation is that you can get pulled into it and you start perceiving that you are in a real situation with everybody in the group. When you don’t have a role or you don’t’ know what to do in your role, then you end up just sort of watching on the sidelines.

**Impact of Presence Centricity on Learning Outcomes**

What is the articulation of presence centricity and the learning experience? A major objective of scenario based HF-HPS is to induce a perception of and involvement in reasoning and managing through a real clinical patient problem represented by the simulation environment. An endocentric presence in a HF-HPS may enable the learner to more cognitively engage in clinical reasoning and in making
clinical judgments over simply participating in task oriented activities disconnected from the logical processes of cue recognition, reasoning, and judgment.

Participants in the study that achieved a more endocentric presence stated that their highest priority concern in the simulation was to assure the patient status and to do all that they could to get the patient back to a stable condition. This reflected an engagement in clinical reasoning and problem solving through the clinical situation. Learners with endocentric presence also perceived a high degree of responsibility for the patient outcome in the simulation. In contrast, participants that were more exocentrically present stated that their highest priority was a self-oriented concern for their personal performance on the simulation tasks that were required. Their comments frequently referenced, “doing the procedures right” or “not looking stupid in front of the teacher.” Learners with exocentric presence had a perception of inconsequentiality of the simulation and a low sense of responsibility for the outcome.

The following passage from a faculty member describes a perspective on the articulation of presence and the learning experience.

I think immersive presence is very important. If they are not present in the situation, they are not going to be processing cognitively. Critical thinking involves being able to process the information in the simulation. If they are just standing back on the outside, passively watching, their mind might be wandering onto other things in their life. Sure, they might be thinking about what they are seeing, but they are not going to be the one who is clinically
deciding. To get the learning out of it, they need to be making the judgment calls, making the decision about what is deterioration and what isn’t, deciding what is significant and what isn’t, when to call the doctor and when not to call. If they are not immersed and present in it, they are not going to be doing any of those cognitive processes. And that was the point of the simulation in the first place.

Presence centricity also seemed to impact the learning experience in a variety of other ways in this study. Learners that were more endocentrically present most often reported very positively about their learning experience. They frequently recounted feeling “like a real nurse” and feeling like they were in a real situation. This student had high endocentricity in the simulation and she described her learning experience in the following passage.

I think that it was a very good learning experience in terms of putting all the pieces together with the patient. Looking at the patient, considering their symptoms, considering their vital signs, their labs, and then what is the best next action to take. I mean there are many things that we could have done, but what is the most, the first thing you would do as a nurse and how that is best for the patient. Yea, so I think it was a good learning experience. Ultimately it makes you, feel like a real nurse. I felt like this simulation was the realist of all the others that I have been in.
In contrast, this student was very exocentrically present in the simulation. Presence seemed impacted by a lack of entry level competencies in this situation. She described the learning experience quite negatively.

Going in I was hoping that this would be a good learning experience. But it didn’t seem real to me at all. It was all of us students just thrown in and we haven’t even ever been in a code before. We were all just standing around like, “What do we do?” It was absolutely devastating because we had to just fumble our way through the situation. You feel so unsupported by it all. You think, “What if this happened in real life.” Then when we walked out of the experience, I still don’t know how a code should really run.

Similarly, many participants described how the simulation experience eroded learners’ confidence. On teacher stated: “It concerns me. A lot of them hate sims because it makes them doubt themselves.” This student also described how the simulation experience eroded her confidence.

I feel so embarrassed because I feel so incompetent about it, you know? It is like this, I know myself. I am a senior nursing student now and will be graduating soon. I think this was so bad because now I am leaving school feeling incompetent and I really wish I could go back in and do it right. I want to say that I feel upset and sad. The worst part is that I still don’t know what I am doing after the experience.
This student had an exocentric presence in the simulation. She seemed to stand back to wait for instructions from the facilitator in the simulation before engaging. Entry level competencies were likely to be a determining factor impacting presence and learning outcomes in this example.

In regard to learning outcomes, a clinical nurse specialist talked about her perception on presence and learning outcomes this way:

I think every participant learns a different amount in simulation unequally. It really depends on their approach and on their participation in the scenario; you know how they engage and involve themselves in it and how they perceive it as real or not. Those that I’ve seen that had bad attitudes of not really wanting to do it, not seeing a benefit to doing it, not participating in it fully on the inside, I don’t think they get the same learning out of it.

The comparative group of professional nurses also demonstrated an impact of presence on the learning experience and on learning outcomes. In this first passage, a nurse educator who is the clinical specialist on a medical surgical unit described how, based on her own observations, the nurses that were really involved in the simulations had increased confidence and assertiveness as well as improved cue recognition and clinical judgment.

The simulations have really increased their confidence and their assertiveness with the physicians. We are getting better recognition of signs and symptoms
of deteriorating patients. So we are getting less failure to rescue now. That is because the nurses are being able to pick up on these signs more efficiently, quicker, earlier, and getting somebody enlisted to do something about it.

Another nurse who was observed to have high endocentricity in the simulation also described the positive impact of the simulation on her professional practice competencies.

You know since the simulation, I have been having some really sick patients. I’m telling you, I keep thinking in the back of my head about the simulation and I am more prepared. I know what I am looking for now. And now when I am walking around my floor, I am very cognizant of where the crash cart is and how all the supplies are organized. Being in the sim definitely made me think about my practice differently. I am much more aware of myself and my environment. I know that I really pay more attention to my patient’s symptoms and trends.

In contrast, another nurse was observed to have a high degree of self consciousness and performance anxiety in the simulation. This was exhibited by breaking out of the scenario to ask questions or to rationalize her actions in the simulation to the facilitator. She seemed to have a bicentric presence that was exocentrically dominant in the simulation. She described the negative impact of this simulation experience on her learning experience in the following passage.
I really didn’t find much learning out of it. I felt like we were all just thrown in and we were set up to fall and stumble down. I felt very unknowledgeable. I knew that there was a lot of learning for me to do there. But I also knew I didn’t handle it well. I just felt very vulnerable and exposed to the whole room. This was very hard on my pride, you know? It just displays all of your weaknesses as a nurse in front of everyone. Worrying about all that just kept distracting me from the clinical situation and just made the whole thing worse. I didn’t know where I fit in. So I just more stood back until I was pulled in and had to do something.

Earlier in the interview, this nurse also described that she had never been in a code situation before. Thus entry competencies not only impacted presence in the simulation but also impacted the learning outcome in this example.

**The Nature and Determinants of Presence in HF-HPS Model.**

The Nature and Determinants of Presence in Human Patient Simulation Model is presented in Figure 5. Based on the results of this study, presence, in dynamic scenario-based HF-HPS has been shown to be multidimensional state of being that is impacted by a complex and interacting array of determinants. The results of this study seem to also indicate that presence centricity may have impact on the learning experience and on learning outcomes.
The model presented displays the linkage between the determinants of presence, presence centricity, and learning outcomes. The determinants of presence are clustered according to the categories of pedagogical factors, individual factors, and group factors. The rectangle boundary around the determinants stands to represent that these factors are in interaction. The arrow toward the presence centricity rectangle indicates that the determinants are in operation before and/or during the simulation learning experience and that they determine the nature of presence experienced in the simulation. Presence centricity is displayed in the central rectangle. Presence centricity is assumed to have the domains of endocentrism, exocentrism, and bicentrism with regard to the participant’s state of being. Presence in HF-HPS is a dynamic state of being within the interplay between the stimuli of the natural environment and the stimuli of simulation environment. Participants are shown in the model at different positions of centricity relative to the simulation environment. The arrow toward learning outcomes indicates the linkage of presence centricity as factor impacting the learning experience and learning outcomes of scenario-based HF-HPS. It is theorized by this model that presence centricity is one factor that may contribute to whether or not HF-HPS is an educative (Dewey, 1938/1986) learning experience that promotes positive learning outcomes.
Figure 5. The Nature and Determinants of Presence in High Fidelity Human Patient Simulation Model
Chapter 5: Discussion

On one hand, a technology is limited by virtue of its thingness; that is, there are hard(ware) limits to what a technology can mean, to what it can do, and for what it can be used. On the other hand, a technology is limitless by virtue of everything we can read into it, design it to be, use it for, and construe it as against.

(Sandelowski, 2000, p. 42)

Significance

High fidelity human patient simulation is an imperfect construction. The technology falls short of the representation and uniqueness of human beings and their health experiences. Human responses are complex, indefinite, emergent, and contextual. There are inconsistencies, delays, accelerations, and variabilities across human health conditions. Life itself is conditional, spontaneous, and transcendent far beyond what can be produced in technology and in what simulation can represent.

Yet, simulation as a technology and a technique is increasingly authentic having the potential to gather up (Heidegger 1954/1977), to make brilliant (Borgmann, 1992), to amplify, and to reveal a variety of elements of the natural phenomena of the world. The increasing authenticity of simulation technology bears close association to the real clinical situation. Simulation environments also “take advantage of the imaginative
ability” of participants to “psychologically transport their presence” (Sadowski & Stanney, 2002, p. 791) to the real clinical situation of which is represented and compared. It is this connection to the experience of reality that presence affords in simulation that bears its significance. Yet, while presence has received wide attention concerning other virtual reality simulations in other disciplines, little notice of presence as a factor is evident in clinical simulation.

The lack of attention to presence in HF-HPS is likely due to the stage of development of research on simulation in nursing and across other health care disciplines. The state of the science regarding HF-HPS is as yet underdeveloped and evidences patterns worthy of note. Currently there is a saturation of evaluation research in the literature. This research has been focused on indirect outcome measures such as self perceived confidence or learner satisfaction. Comparatively, there are a small number of studies on learning outcomes. Of those outcome studies that do exist, there are mixed results on knowledge and critical thinking outcomes. There is also a lack of attention to clinical judgment and intervention competencies achieved through simulation. Much of the research evidences assumptions concerning scenario, technology, learner, context, and pedagogical features. There is also high variability across studies concerning these elements and a lack of control of potential confounding variables such as previous simulation or clinical experiences. Lack of adequate documentation of such features in simulation hampers comparability between studies and limits replication. The literature also demonstrates a noticeable lack of theoretical and conceptual foundation for the studies; although, a major contribution has been made through the NLN/Laerdal
collaborative study that resulted in the development of the Nursing Education Simulation Framework (Jeffries, 2005, 2007).

The important question of drawing from work on simulation related research from other domains or disciplines for examination of the applicability of this work to healthcare related simulation has been noted by the Society for Simulation in Healthcare Consensus Summit (Dieckmann et al., 2011). Presence has received wide attention across technology, engineering, military, psychology, and communications studies for its central importance to the participant’s experience with virtual reality simulation and the likely impact on task performance and a variety of other outcomes. The close connection with reality that presence affords in simulation makes presence a potentially important consideration for research concerning healthcare related simulation.

Yet, as a mixed reality form, HF-HPS represents a different socio-technical milieu than virtual simulation in other domains necessitating study of the nature, relevance, and applicability of presence in the healthcare simulation domain. The aim of this study was to explore whether and how presence was operational in HF-HPS. The study sought to examine the nature of presence in terms of domains and dimensions. It was also a goal of this research to develop a conceptual model that might explain determinants of presence as well as the potential impact of presence on learning outcomes in the context of HF-HPS.

The nature of presence found in HF-HPS in this study is consistent with and supports evolving conceptualizations of presence from other disciplines and domains of simulation. The nature of presence was found in this sample to be multidimensional and
complex. Presence was conceived, much as others have found, as having the dimensions of immersion and engagement (Witmer & Singer, 1998; Slater & Wilber, 1997), perception/suspension of disbelief (International Society for Presence Research, 2000; Slater et al., 1994), cognition (Lee, 2004), action/agency (Zahorik & Jenison, 1998; Herrera et al., 2005), and psychological responses (Herrera et al., 2005).

Based on the results of this study, the nature of presence is considered here in the context of interaction mediated by HF-HPS. Presence is conceptualized as a sensory-perceptual, cognitive, psychological, and actional engagement in an experience mediated by simulation where the stimuli of the simulation environment immerses the user in an artificial representation of a natural human phenomenon and where the individual perceives the experience at a level of realism and salience as an agentic, caring self.

The Nature and Determinants of Presence in Human Patient Simulation Model further conceptualizes presence as a dynamic state of being having a centricity between the simulation environment and the natural surrounding environment where participants perceive the stimuli from one environment as salient over the other. The centricity of presence in HF-HPS has primary domains of either exocentricity or endocentricity relative to the simulation environment. As a dynamic state of being, participants may be drawn inside or outside of the simulation situation (breaks in presence) and/or may experience both the simulation and the natural environment simultaneously (bicentricity) but at different degrees of salience.

Earlier work on presence in other disciplines conceived of presence as existing in exclusive modes (Biocca, 1997). In this study, the concept of centricity of presence and
the interpretation of presence in simulation as a dynamic state of being where the stimuli of either the natural environment or the simulation environment is salient supports and expands the more recent work on the nature of presence. Ijsselsteijn (2002) described participants in simulation as experiencing more than one environment at a time at varying intensity. Findings in this study support this notion. Participants in this study experienced presence in a primary domain of either endocentricity where the perception of the simulation environment was salient or exocentricity where the perception of the natural, proximal environment was salient. However, participants moved in and out of these states of being and most typically perceived both environments simultaneously (bicentricity) even though one or the other of the environmental stimuli was the dominant perception. This study contributes to evolving understanding of presence by identifying the domains of the centricity of presence in simulation.

Results of this study also support more recent understandings of breaks in presence in simulation. Breaks of presence are the dynamic states of being in simulation where the participant abruptly stops responding to the virtual stream of stimuli and instead immerses in the stimuli of the natural, proximal environment (Slater & Steed, 2000; Brogni et al., 2003; Garau, et al., 2008). Breaks in presence were also noted in this study and were typically invoked by distraction from natural, proximal environment. The finding of breaks in presence further supports the conceptualization of presence in simulation as a dynamic state of being.

The model also explains multiple and complex determinants of presence in HF-HPS. The determinants are clustered into the categories of Pedagogical Factors,
Individual Factors of participants, and Group Interaction Factors. These determinants include factors that may be existent or derived prior to the simulation and/or may interact during the implementation of the simulation. Pedagogical factors include scenario design, stream of stimuli, and instructional processes. Individual factors include: personality characteristics, referential experience, preconceptions, emotional responses, and entry competencies. Group Factors include group dynamics and structural role elements.

The determinants of presence in HF-HPS found in this study bear both similarity and difference from those determinants of presence found previously in studies of virtual simulations. Most generally, the determinants of presence in virtual simulation are classified as user factors and media factors (Ijsselsteijn & Riva, 2003; Slater & Usoh, 1993). Generally there is both similarity and dissimilarity in the determinants of presence related to media characteristic due to the wide variability in technology specific features and the nature of virtual versus mixed reality forms. Yet there seems to be some convergence on the determinants of presence found in virtual simulation studies with this study of HF-HPS related to user or participant factors.

The variety of technology specific features that impact presence in virtual reality forms have been catalogued in Kalawsky (2000). User and media forms in virtual reality simulation have also been articulated in Jones (2007), Ijsselsteijn and Riva (2003), and Slater and Usoh (1993). These generally include the features of foreground/background, sensory stimulation, field of view, visual framing, and realism. Media features impacting presence are comparable to the degree of similarity in the forms of media.
The determinants of presence in virtual simulation above that are specific to on-screen media (foreground/background, field of view and framing) are dissimilar to those found in this study on the basis of the difference in the technology/technique involved in HF-HPS as a mixed reality form. Yet, the elements of sensory stimuli and realism (termed fidelity with respect to HF-HPS) were similarly found to be determinative of presence in HF-HPS in this work. With due regard to the differences in technology and the type of stimulation immersing the participant in the simulation, these findings are comparable to the determinants on realism found by Freeman, Avons, Medis, Pearson, and Ijsselsteijn (2000), and sensory stimulation found by Ciflikli, Isler, and Gudukbay (2010), Vastfjall (2003), Larsson, Vastfjall, and Kleiner (2001), Slater, Steed, McCarthy, and Maringelli, (1998) and Hendrix and Barfield, 1996b. Furthermore, content, as a media determinant, has also been found to determine presence in virtual simulations (Grassi et al., 2008). Findings in this study are also consistent with this factor. Scenario design provides the content of the simulation in HF-HPS and was similarly found to be determinative of presence in this study.

A variety of user factors that impact presence in virtual simulations have been previously identified. There is a general convergence among the individual factors found to impact virtual simulations with those that impacted presence in HF-HPS in this study. Converging factors include immersive/perceptual tendencies, personality characteristics, cognitive factors (attention and focus), and emotional responses. These have been previously identified in studies of virtual simulations in Bouvier (2008), Jernet, Beciu and Maldonado (2005), Banos et al. (2004), Hoyt et al. (2003), Sas, O’Hare and Reilly
(2004), and in Witmer and Singer (1998). Yet there were other individual factors including referential experience, preconceptions, and entry competencies, as well as group factors that were found to be determinative of presence in HF-HPS in this study. These factors may be at play in other forms of virtual simulations but have yet to be studied. Alternatively, these factors may be unique to mixed reality simulations such as HF-HPS where a more complex state of presence may exist due to the mixing of virtual and real contexts.

The determinants of presence found in this study also build upon the initial study of presence in HF-HPS by Dieckmann, Manser, and Wehmer (2003). These authors similarly found emotion, anticipations/expectancy, role factors, flow of events, and task related factors as influences on presence in HF-HPS scenarios. The concept of task related factors including workload and workday in the Dieckmann et al. (2003) study may by similar to the finding of cognitive overload associated with the pace and foci of the stimuli from the simulation that exceeded the cognitive capacity of the participants in this study. Perhaps the difference in these studies is only the causation of the overload. These authors described a host of other factors at lower levels of abstraction from the present study. This study builds on the Dieckmann et al. (2003) study by raising the level of abstraction on the categories of determinants of presence perhaps allowing for a clearer understanding of relevance and amenability to technological or pedagogical considerations for enhancing presence in simulation.

The state of presence found to be operational in HF-HPS in this study also demonstrated evidence of impact on learning outcomes. Participants that were
endocentrically present reported gains in clinical knowledge, task competency, cue recognition, clinical reasoning, clinical judgment, increased confidence, and a perceived sense of responsibility and accountability for the patient outcome. Yet, participants having a more exocentric presence, irrespective of the determinant of their state of being, reported negative learning experiences and learning outcomes. These participants perceived high levels of anxiety, embarrassment, vulnerability, and eroded self confidence. They also reported lack of gain in clinical knowledge or task competency.

The differences in self reported outcomes in this study suggest that determinants of presence and the state of being present in simulation may result in either educative or miseducative learning experiences.

As such, presence may be an important concept for consideration in the existing model of simulation in nursing education (Jeffries, 2005, 2007). This model of simulation in use for HF-HPS in nursing is in developmental stages in terms of the articulation of determinants or dimensions that may impact learner outcomes. As such, presence as a conceptual component or element in The Nursing Education Simulation Framework (Jeffries, 2005, 2007) is as yet unaccounted for. The concept of presence could expand this model to account for a potentially important learner dimension that may impact learner outcomes. Therefore, it is important to consider the articulation of presence within this framework for simulation in nursing education.

The Jeffries (2005, 2007) framework is based on five conceptual components of simulation. These components include the interaction of teacher, student, educational practices, and simulation design characteristics as these factors interact together to impact
outcomes. Each of these components also is comprised of a number of sub-variables. Successful outcomes of simulation are proposed to be impacted by the variables in the learning context and the degree to which best practices related to the conceptual components are designed and implemented (Jeffries, 2005, 2007).

Several of variables that may impact simulation learning outcomes in the Jeffries (2005, 2007) framework also impacted presence in this study. These variables include: simulation design, individual student factors, and several factors under educational practices in the framework. Therefore, presence may be a mediating influence on learning outcomes that may need to be accounted for in this model. The articulation of presence as a concept that could build on the Nursing Education Simulation Framework would be considered a factor that occurs in the scenario implementation phase. Scenario implementation is implied in the Jeffries (2005, 2007) framework by the intersection of teacher, student, and educational practices and the linkage with the simulation design component of the model.

Implications for Nursing Education

The development of the Nature and Determinants of Presence in HF-HPS model was directed at supporting the development of instructional design and pedagogical science around human patient simulation in nursing education. This study was also aimed at the conceptual modeling of the concept presence, a state of being that is fundamental to the participant’s learning experience in simulation and also may mediate on learning outcomes. It is theorized in this model (Figure 5) that pedagogical,
individual, and group factors are determinative of presence centricity and that the
centricity of presence in simulation may influence both the learning experience and
learning outcomes. In the model it is further theorized that a more endocentric centricity
of presence of participants in HF-HPS may contribute to effectuating a more educative
experience and more positive learning outcomes.

Within the categories found that may determine presence were also elements that
were either facilitative or inhibitory of an endocentric presence. Considering pedagogical
determinants of presence, elements of simulation design, stream of stimuli, and
instructional processes seemed to impact presence centricity in this study. When the
objective of the simulation was instructional, participants more easily achieved an
endocentric presence. Yet, when the objective was evaluational or perceived as such,
endocentric presence was inhibited by performance anxiety. The scripted scenario design
also impacted endocentricity. Higher intensity and more dynamic state changes related to
the clinical situation were more facilitative. Additionally, factors of fidelity in the
simulation design were facilitative when greater fidelity to the patient presentation,
clinical situation, instrumental tasks, and clinical processes was achieved. The stream of
stimuli during implementation of the scenario was found to have potentially high impact
on presence centricity. When the pace of cues or state changes was too rapid or when the
focus points in the simulation had greater number or complexity, endocentric presence
seemed inhibited by cognitive overload. But when facilitators dynamically paced cues
and state changes and the simulation had a lesser number of foci, a more endocentric
presence was effectuated in participants. Embedded, collaborative, and authoritative
versus external or authoritarian instructional or facilitation approaches also seemed to have a more positive impact the centricity of presence in this study.

An array of individual factors seemed to determine presence centricity among participants in HF-HPS in this study. The personality characteristic of openness to the simulation experience facilitated more endocentric presence. Participants with immersive tendencies such as imagination, curiosity, or attentiveness were open to the simulation experience and seemed to exhibit a greater susceptibility to endocentricity. The degree of extraversion / introversion facilitated or inhibited presence in relation to the comfort level with role play and pretense that is part of the enactment of HF-HPS. Motivation also seemed to have bearing on the susceptibility toward an endocentric presence among participants in this study where higher motivation seemed to be more facilitative. Referential experience and preconceptions impacted presence. When students could draw upon related or comparative experience from clinical or lab, to the degree that the experience was congruent with the simulation, this facilitated endocentric presence. On the other hand, preconceptions seemed to have an inhibitory effect on presence relative to the simulation. Participants that had prior knowledge of the scenario progression or outcome seemed to experience altered cue recognition and premature closure on cue stimuli or anticipation of the outcome that led to a more task oriented and exocentric state of being in the simulation. Individual differences in the emotional response to simulation seemed to bear on presence centricity. High performance anxiety seemed to have a strong inhibitory impact on the participants’ experience of presence in the simulation. Lastly, the entry competencies of participants concerning knowledge and clinical skills
required in the elements of the simulation were among the individual differences that
determined presence. Requisite knowledge and skill/task competency among students
were facilitative of endocentric presence.

Considering group factors as determinants of presence in HF-HPS, elements of
group dynamics and group structure seemed either facilitative or inhibitory of an
endocentric presence among participants in HF-HPS in this study. The familiarity among
group members and group cohesion fostered a more endocentric presence since group
members felt more trust and commitment to a shared goal. Lack of familiarity among
group members in the simulation seemed to lead to discomfort, self-consciousness,
performance anxiety, and an exocentricity of presence in the simulation. The structural
element of group size seemed to have strong impact. Group size exceeding four
members had an inhibitory impact on presence in the simulation. Larger group size
decreased opportunity for active role-taking which promoted exocentricity. Larger group
size also increased performance anxiety among the members in active roles, also
prompting exocentricity. Role factors were also strongly influential on presence in this
study. Students assigned to active roles seemed to experience greater susceptibility to
endocentricity in the simulation. Yet, students assigned to unfamiliar roles or roles other
than those roles for which they were being trained experienced role ambiguity and role
conflict inhibiting endocentricity. Roles of facilitators in the simulation also impacted
presence. When facilitators enacted their role stereotypically or overacted, this seemed to
encourage exocentricity. Additionally when facilitators were assigned to
multiple roles, the role overlap led to confusion and inhibited endocentricity in the simulation. Lastly, intrarole conflict or ambiguity inhibited presence when participants felt unsupported in the simulation. Yet, access to the normal role network and hierarchy that is present in the healthcare team structure and process facilitated presence among participants in this study.

These elements may be useful for instructional considerations. Data from this study may lend insight into strategies with potential to impact pedagogical, individual, and group factors that were shown to determine presence centricity in this study. These theoretically based strategies may facilitate endocentric presence and learning outcomes in scenario based, high fidelity human patient simulations. In Table 4 is presented a summary of factors and strategies that emerged from this study that seemed to facilitate endocentric presence among the participants in high fidelity human patient simulations. These strategies may assist educators in considering instructional approaches that may impact presence and learning outcomes. Note that these strategies are aimed at instructional and dynamic, scenario based HF-HPS and may not be relevant to the use of HF-HPS for evaluation or competency testing situations. These strategies may also not be relevant to instrumental skill training or task oriented simulations. These strategies also require further research to validate their relative impact on presence and learning outcomes.
# Strategies That May Facilitate Endocentric Presence in Scenario Based High Fidelity Human Patient Simulation

<table>
<thead>
<tr>
<th>Pedagogical Factors</th>
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<tr>
<td><strong>Simulation Design</strong></td>
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<tr>
<td>▪ Define and articulate the purpose and objectives of the simulation.</td>
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<td>▪ Orient students to expected learning outcomes and performance metrics.</td>
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<tr>
<td>▪ Increase the fidelity to the clinical situation, instrumental tasks, and actional processes.</td>
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<td>▪ Consider the number of state changes and cue intensity in the scenario.</td>
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<th>Stream of Stimuli during Scenario Implementation</th>
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<tr>
<td>▪ Consider limiting the number of focus points in the scenario.</td>
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<tr>
<td>▪ Pace the stream of stimuli in relation to the demand of the simulation and student response.</td>
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<tr>
<td>▪ Match the cognitive, psychomotor, and affective demand of the simulation to the skill level of learners.</td>
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<tr>
<td>▪ Provide flexible and dynamic facilitation in response to the demand of the simulation.</td>
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**Table 4. Strategies That May Facilitate Endocentric Presence in HF-HPS**
Table 4. Continued

**Pedagogical Factors continued**

**Instructional / Facilitation Process**
- Use collaborative / authoritative versus authoritarian teaching / facilitation style.
- Use an embedded versus external / outside instructional / facilitation approach.
- Avoid the use of faculty / staff responsible for student evaluation in simulation unless evaluation is the purpose of the simulation.
- Utilize a predominance of student initiated versus educator initiated instructional breaks in the scenario; Use educator initiated instructional breaks for issues of safety or errors as relevant to the situation.

**Individual Factors**

**Personality Characteristics**
- Assess and consider students’ characteristics of introversion / extraversion for simulation preparation assignments, role assignments, and facilitation.
- Assess and consider students’ openness to the simulation experience for simulation preparation assignments, role assignments, and facilitation.
- Assess and consider students’ motivation related to the simulation for simulation preparation assignments, role assignments, and facilitation.

**Referential Experience & Preconceptions**
- Reduce the likelihood of premature discovery of scenario progression or outcome to allow for the process of cue recognition and self discovery in the simulation.
- Vary the scenario progression and outcome between repetitions for different groups of students to prevent preconception and anticipation in the event of premature discovery of scenario progression and outcome.
- Provide comparative subject matter in theory, clinical, and lab instruction prior to the simulation for referential experience and wisdom that students may draw upon.
Table 4  Continued

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<th>Individual Factors continued</th>
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<tr>
<td><strong>Emotional Response</strong></td>
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<tr>
<td>▪ Address performance anxiety with anxiety reduction activities and facilitation approaches.</td>
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<tr>
<td>▪ Utilize simulation to teach students to manage anxiety or to make anxiety productive during comparative and intense clinical situations that would also provoke anxiety.</td>
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<tr>
<td><strong>Entry Knowledge &amp; Instrumental Task Competencies</strong></td>
</tr>
<tr>
<td>▪ Provide instrumental skills labs for tasks required in the simulation prior to the simulation.</td>
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<tr>
<td>▪ Provide learning experiences related to the requisite knowledge for the simulation prior to the simulation.</td>
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Table 4 Continued

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<th>Group Factors</th>
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<tr>
<td><strong>Group Dynamics</strong></td>
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<tr>
<td>- Consider familiarity and cohesion of group members when assigning groups for simulation.</td>
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<tr>
<td>- Utilize simulation to teach skills related to team and group dynamics.</td>
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<tr>
<td>- Provide learning activities that support development of leadership skills prior to or during simulation.</td>
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<tr>
<td><strong>Group Structure</strong></td>
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<tr>
<td>- Limit group size to 4 participants when feasible.</td>
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<td>- Assign participants to roles for which they are training; avoid role assignment to roles that may induce intrarole conflict.</td>
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<tr>
<td>- Assign participants to roles for which they are familiar with the expectations; avoid assignment to unfamiliar roles that may lead to role ambiguity.</td>
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<tr>
<td>- Provide interdisciplinary role structure and hierarchy when feasible.</td>
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<tr>
<td>- Avoid role overlap caused by facilitators acting in more than one role.</td>
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<tr>
<td>- Encourage participants and facilitators to enact roles congruent with professional expectations of that role; avoid stereotypic or overacted role play.</td>
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Limitations

It was the purpose of this grounded theory study to develop an explanatory model to not only describe the nature of presence in HF-HPS but also to attempt to account for the variation in presence experienced by participants that may in turn impact learning outcomes. Being that the ultimate applicability of the model is to guide pedagogy around teaching with HF-HPS and to support research around best practices and improved learning outcomes, limitations of this study do apply. Limitations concerning sampling, method, researcher positioning, and results are offered here.

Sampling in this study followed established practices in a grounded theory study with the use of iterative rounds of purposive and theoretical sampling. The use of comparative groups of second degree nursing students, professional nurses, nurse faculty, and administrators aimed to also de-center the primary subject and to seek a consensus of voices on emergent concepts and linkages. Still, the sample is limited by the homogeneity of participants for gender and ethnicity. Approximately 87% of the sample consisted of white females despite the sample being drawn from three sites including a large Midwestern university comprised of a diverse student body. However, the sample of 13% male participants exceeded the current representation of men in nursing which is reported at 9.6% of those licensed since 2000 and 7% overall (U.S. Department of Health and Human Services, 2010). The sample of 13% non-white participants is slightly lower
than current national statistics reported as being 16.8% nonwhite nurses in the current workforce (U.S. Department of Health and Human Services, 2010).

The sampling was also limited by a narrow range of simulation scenarios. The simulations in this study were all dynamic, scenario-based, high acuity, medical surgical patient care situations. Therefore, pediatric, obstetric, psychiatric, surgical, trauma or community health/disaster simulation scenarios were not included in the sampling. The exclusion of low fidelity or task training simulations was purposeful since presence is not typically a learning objective in static, instrumental, or task training laboratory simulations.

Limitations of method also are noted here. Data was collected in this study by observation, individual interview, and group debriefing interviews. The use of focus group interview as a method in grounded theory studies has been criticized by Morse (2001) for the potential of yielding snippets of data and a disjointed data structure. The debriefing group interviews in this study were captured as they were an integral component in the simulation pedagogy. The time with participants may also have increased credibility in that the immediacy of the interview following the learning experience would decrease the likelihood of significant memory degradation. Additionally, the group interviews were used only as supplemental to the individual interview data collection. In-depth semi-structured individual interviews were conducted within 30 minutes – 48 hours after the simulation experience providing a rich data corpus.
Charmaz (2001) has also warned of the use of one shot interviewing techniques in grounded theory studies for the risk of undermining the data. Simulation is a one to two hour experience in a learner’s life. Therefore, a 30-60 minute, semi-structured interview allowed for a deep exploration of this limited and circumscribed life experience. Recognizing still this risk, the sampling method included an iterative return to the primary sample for a second round of sampling and data collection to allow for the opportunity to correct potential errors and to densify the analysis as Charmaz (2001) has suggested.

While interviews are one of the most common methods of data collection in qualitative research, there are noted limitations of individual interviews as a method. An interview is never neutral and likely results in a negotiated text that is wrought with researcher participant interaction (Kvale & Brinkmann, 2009; Fontana & Frey, 2005; Rubin & Rubin, 2005; Scheurich, 1995). In this study there may have been impact from a perceived asymmetry of power where participants may have tried to provide what they interpreted to be the socially desired answer. As Fontana & Frey (2000) noted, while age, gender, and experience tend to have a lesser impact on responses, student interviews with higher status interviewers may produce larger response effects. To mitigate this impact, it was made known to interviewees that I was either not associated with the schools or institutions that participants attended and / or was not associated with the course for which they were enrolled. Participants were enlisted as partners in the research process. Reflexive journaling and notations on transcripts were also utilized to note where interactions were likely to have been significant for analytical consideration.
Participants may also have been impacted by the audio-recording during the interview process and video-recording of the simulations. Permission was obtained for recording all the interviews and simulations observations. Presence of the audio-recorder may have constrained or encouraged participants regarding sharing the narrative of their interview (Rubin & Rubin, 2005). Recording was viewed in this study as less obtrusive to the interview than note taking. Additionally, participants seemed to forget about the recording shortly into the interview and at times continued talking when the recorder was turned off signaling the end of the interview. Video-taping may have impacted the presence of participants in the simulation. To lessen the impact of video-recording, participants were informed that only the researcher would view the video-recording and that all recordings would be destroyed following the study. The video camera was not visible to participants. Recording impact seemed to be low since during the interviews many participants remarked that they had totally forgotten that the simulation had been video-recorded.

Loss of meaning and data reduction may have also occurred through the transcription and coding analytics. Reliability of the transcriptions was verified throughout the research process. Verbatim transcripts were routinely validated through a process of simultaneously reading the transcript and re-listening to the audio file for accuracy. The process of coding in this grounded theory study was recognized as an interpretative act and also as requisite to the methodology. The conceptual model derived from this process is given as one possible interpretation of the nature and determinants of presence in HF-HPS.
The concepts that emerged in this study were categorized into discrete elements for the purpose of the identification and exploration of dimensions and determinants of presence and for modeling a theorized linkage between concepts. Presence as a state of being in interaction is considered epiphenomenal. Therefore it is possible that other dimensions and determinants of presence exist. Additionally, among the determinants of presence, there may be overlaps and interactions. The model is not intended to indicate discrete factors that are operational in isolation. The model is limited by potential interaction effects among the determinants of presence. The determinants may also have more or less impact on presence centricity and learning outcomes.

**Implications for Future Research**

It is hoped that the Nature and Determinants of Presence in High Fidelity Human Patient Simulation Model (Figure 5) will link to existing conceptual models for simulation in nursing and will provide an adjunctive framework for research that could lead to the further development of a pedagogical science for human patient simulation in nursing education. To that end, this model stimulates potential useful questions for future research. Results of future studies may also help lend support to the linkages in the model. Potential areas for future research are given here.

- Impact of presence centricity in HF-HPS on the learning experience and learning outcomes.
- Impact of breaks in presence in HF-HPS on the learning experience and learning outcomes.
• Research on the magnitude of impact of determinants found to facilitate or inhibit presence in HF-HPS
• Research on the stream of stimuli (pace and foci) in HF-HPS related to presence, cognitive load, and/or learning outcomes.
• Research on pedagogical considerations related to assisting participants with individual tendencies (i.e. resistance, introversion, immersive tendencies) that inhibit presence in simulation and/or hamper learning outcomes.
• Impact of referential experience and preconceptions relative to simulation and learning outcomes.
• Impact of entry competencies (cognitive and task competencies) related to the demands of the simulation on presence and learning outcomes.
• Research on facilitation methods and instructional processes for HF-HPS that may enhance presence centricity or improve learning outcomes.
• Research on pedagogical considerations to decrease performance anxiety or to capitalize on productive uses of anxiety in simulation to enhance presence and/or improve learning outcomes.
• Impact of group factors (size and role structure) in HF-HPS on presence and learning outcomes.

Considerations around next steps for research effort on HF-HPS should be given to prioritization and sequencing in relation to the current status of knowledge and in relation to developing a pedagogical science. Research priorities have been established
by the Society for Simulation in Healthcare at the First Research Consensus Summit (SSIH, 2011). Aligned with these priorities, this research brings to attention the experience of presence in HF-HPS as a potentially important dimension of the learner’s experience and learning outcomes. This research may also make a small contribution to theory development and beginning development of pedagogical science around HF-HPS. Next steps in relation to the implications from research generated from this study should reflect a concern for the nature of the impact that presence may have on learning outcomes. Additionally, the factors found to impact presence may be more or less determinative and more or less relevant to pedagogical or technological consideration. Thus, determinants found to have stronger impact in this study and those more relevant to pedagogical or technological considerations should be of higher priority for research effort.

In the broader picture, simulation is but part of the larger trend toward the mediation of technology on the professional and therapeutic relationship between nurses or other health care providers and their patients. The acceleration and intensification of technologies such as simulation, robotics, and telehealth services in healthcare increasingly make indirect or even disrupt the caring relationship. What do these increasingly indirect means of educating nurses by simulation mean in terms of transfer to live human care? Will presence centricity in simulation also extend to translational patient outcomes? What is the relevance of presence with other emerging technologies that stand between nurses and their patients?
Conclusion

The adoption of high fidelity human patient simulation in nursing education is likely to accelerate due to the many factors propelling its use. The potential impact of simulation on nursing education and ultimately on health care has the potential to be transformative. Yet the trend toward adoption of HF-HPS has preceded a sufficient and necessary evidence base to support its use. Presently, the pedagogical science is underdeveloped to guide instruction by HF-HPS and to assure effectiveness related to the learner experience as well as translational learning and health care outcomes. This encumbers the discipline to seek to understand factors impacting translational outcomes and to develop best practice pedagogy to assure the educative value of simulation and an ultimate positive impact on health care.

One of the major aims of dynamic, scenario-based high fidelity human patient simulation is to induce a sense of presence in the learner to enable an experience of a simulated reality of a human health care situation. Where the learner may experience presence perceiving the simulation environment as salient over the unmediated external environment, the learner may have opportunity for cue recognition and, in response, to enact clinical reasoning, clinical judgment, and clinical agency in task, intervention and/or role performance. Scholarship on presence in virtual simulations has shown positive impact on learning outcomes. Perhaps presence centricity in HF-HPS may also have positive impact not only on learning outcomes but also on translational patient outcomes as well.
The aim of this grounded theory study was to examine the nature of presence in nursing students participating in HF-HPS and to develop a conceptual model that could potentially explain the dimensions and determinants of presence as they may impact learning outcomes. In the model developed through this study, pedagogical, individual, and group factors are theorized to be deterministic of the centricity of presence among nursing student participants in HF-HPS. The centricity of presence is also theorized to impact the learning experience and learning outcomes. The Nature and Determinants of Presence Model is presented to further guide research on factors that may impact learning outcomes in HF-HPS in support of the continued development of a pedagogical science for education with clinical simulation.

The words of Dewey (1938/1986) remind us that all experience is not necessarily educative. Experiences can be, instead, miseducative if they do not contribute to students’ growth or lead to the understanding or appreciation of later life experience. It is theorized here that through the impact of pedagogical, individual, and group factors on the centricity of presence, that HF-HPS could be either an educative or miseducative learning experience. Furthermore, Dewey (1938/1987) held that educative experiences are those held under highly specialized conditions and in specialized environments. High fidelity human patient simulation is indeed a specialized educational technique and learning environment. But the key to assuring that it is also an educative experience is to also hold simulation under highly specialized conditions. Perhaps this study can make a small contribution to the understanding of these specialized conditions and the further development of a pedagogical science for human patient simulation in nursing education.
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Appendix A: Interview Guides
The Nature of Presence Among Nursing Students in High Fidelity Human Patient Simulation

Interview Guide – Nursing Students

ID:______Obs #_____Gender_____Age_____Ethnicity_____Date______

1. How would you describe the simulation episode? How would you describe the patient? What was the problem? How would you describe yourself in the simulation?

2. Please describe your experience in the simulation in as much detail as you can.

3. Throughout the simulation, did you come to see your situation in any different ways?

4. Please describe your focus during the simulation? What were you aware of during the simulation? (Please describe). Were there times that you were totally engaged and did not notice anything else in the room? (Please describe) Were there times that you were disengaged/distracted from the situation and aware of other things going on? (Please describe).

5. What did you sense or perceive during the simulation?

6. Please describe your involvement during the simulation?

7. What were your major concerns during the simulation? How did your concerns change during the simulation?

8. What were your priorities during the simulation? How did your priorities change during the simulation?

9. How would you describe your interactions during the simulation? How would you describe others participating in the simulation?

10. How would you describe your awareness of the patient status during the simulation?

11. How would you describe your awareness of interventions during the simulation?

12. How would you describe your clinical care performance during the simulation?

13. What were you thinking about during the simulation?

14. How would you describe your emotions during the simulation?
15. Describe your feelings about the patient outcome?

16. How were your actions affected by others in the simulation?

17. How would you describe the patient mannequin?

18. How did the simulation situation compare to a real patient care situation?

19. Probes and inquiries on markers related to participant responses to questions.

20. Questions developed in response to emergent themes/categories and theoretical insights.
The Nature of Presence Among Nursing Students in High Fidelity Human Patient Simulation

Interview Guide - Faculty

Interview: Participant ID:_____________Role_______________Date________
Gender____________Age____________Experience____________

1. How would you describe your role in simulation?
2. How would you describe your impact on students during simulation?
3. How would you describe students’ state of being in a simulation?
4. How would you describe students’ focus during the simulation?
5. Thinking about being immersed/engaged in something as if it is real situation, what would you say about students’ presence in a simulation.
6. Thinking about students being involved in the situation; (i.e. not noticing actual environment), what would you say about students’ involvement?
7. How would you say that students come to see their situation or state of being at the beginning versus the end of the simulation?
8. Would you say that students are ever totally distracted by the outside environment during the simulation? If so, what distracts them?
9. How would you describe the teacher’s effect on the simulation?
10. What factors would you say increase students’ engagement/immersion in the simulation?
11. What factors would you say distract students in the simulation?
12. How would you describe the impact of the pace of the simulation on the students’ response
13. How would you describe the foci of the scenario and the students’ response to the simulation?
14. How would you describe the impact of roles in the simulation?
15. How would you describe the impact of the mannequin in the simulation; moulage, etc?
16. What do students sense or perceive in the simulation? What are they aware of?

17. What is the student's main concern?

18. What is the student's highest priority during the simulation?

19. How would you describe students' interaction/communications during simulation?

20. How would you describe students' perception of the patient?

21. How would you describe students' interaction with the patient?

22. How would you describe students' emotional response during simulation?

23. Would you say students enact themselves as the nurse or as the student?

24. How would you say that students perceive their own sense of responsibility or accountability for the outcome in the simulation?

25. How would students' responses to simulation compare to their responses or interactions to real patient care.

26. How would you describe the outcomes of the simulations?
Appendix B: Observation Guide
The Nature of Presence Among Nursing Students in High Fidelity Human Patient Simulation

Observation Framework: Group ID_________Obs #_______Date_________

I. Descriptive Observation (Domains)
   A. Actors
      i. Roles
      ii. Feelings/Emotions
      iii. Interactions
   B. Actants
   C. Place/Space
   D. Objects
   E. Activities and Events

2. Focused Observation (Domains)
   A. Emergent Categories
   B. Sensory-perceptual aspects
      i. Engagement/Involvement
      ii. Immersion
   C. Cognitive aspects
   D. Psychological aspects
   E. Actional/agentic aspects
   F. Hierarchical (Role/Relationships/Power) aspects
   G. Processual aspects
   H. Causation/Consequential aspects
   I. Meanings

3. Selective Observation (Domains): Theoretical Insights – Emergent Categories
Appendix C: Simulation Scenario Descriptions
Scenario 1: Care of Post Op Mastectomy Patient

Authored By: Carolyn Schubert DNP, RN-BC, Faculty, The Ohio State University, College of Nursing. Reprinted with permission from the author.

Scenario Description

Patient is a 53 y.o. female, weight 79 Kg admitted to a med/surg unit or PACU. Patient is 16 hours post op following modified radical mastectomy. Patient has a couple of staples pop after being moved to bed from PACU. Dressing becomes saturated and JP drainage increases. Patient is experiencing pain and nausea not controlled with PACU meds. Patient develops complication of acute blood loss, low hemoglobin, and requires a blood transfusion which results in a transfusion reaction. The simulated clinical experience will automatically progress to an allergic reaction from the blood transfusion. With prompt recognition and intervention, the patient stabilizes.

Simulator Set Up Notes

- Dress in hospital gown and wig
- Dress with chest binder
- Left chest with incision and staples
- Patient on room air
- Simulate 75 mL sanguinous drainage in JP drain
- Have dry dressing over JP drain
- Urinary catheter, foley and simulated urine
- CVC in R subclavian. Attach D5.NS at 125mL/hour in distal port
- Saturated ABD dressing in place over left breast staples/incision, cover with chest binder
Scenario 1 continued

Simulator Set Up Notes continued

- Suction set-up with yankauer
- Simulate rash on back with label or moulage
- Documents for simulation: copy of orders from sim template for planning, blank blood component release slips, completed donor slip, patient armband, blood transfusion policy reminders, blood bank order form, blank transfusion reaction battery, signed transfusion consent form, copy of blood administration record printout, blank blood administration record and transfusion reaction investigation forms, blood transfusion highlights.
- Add 50mL of urine to foley bag midway through scenario.
- Have SBAR, SPARQ communication tools available in the room.

Supplies: IV administration kits, fluids, blood administration kits, venipuncture supplies, oxygen set ups, wall suction, medications, dressing supplies, ECG monitoring, BP, SpO2 and temperature.

Report: Mrs. Samuels is white female s/p left modified radical mastectomy and axillary lymph node dissection. B/P 110/72, Pulse: 78, RR: 12, T: 97.4, last O2 sat 98% on room air. IV infiltrated in right antecubital, CVC inserted and verified by CXR. D5.9NS infusing at 125 mL/hr. Dressing dry and intact. Patient tolerated procedure well. EBL 150 mL. 100mL JP drain in place on the left with bright red drainage. Last drainage amount was 20 mL. JP drain emptied prior to transport. Foley to straight drain. Urine output 50 mL, emptied prior to transport. Has had Hydromorphone total of 2 mg. in PACU. 1 mg IVP last given 20 minutes ago. Current pain rating is 2. Promethazine 12.5mg given 30 minutes ago for nausea. No emesis. NKA. Binder to chest in place. Dressing under binder intact with 2cm dark red drainage.

Lab values: Hgb 12.3 Hct. 36 on admission, now Hgb 10.0 and Hct 30. Alert and oriented but drowsy. Bowel sounds are present but hypoactive. Patient remains on ice chips only. Post op orders have been entered. Family is in waiting room.
### Scenario 1 continued

**Mastectomy Post Op Orders on Chart**

| Medications | Ancef 1000mg. IVPB, Q8hrs x 3  
|             | Promethazine 25 g. IV Q6hrs PRN. May give 12.5 – 25mg for nausea  
|             | Dilaudid 2 mg. IV PRN Q2hrs for severe pain 7-10/10  
|             | Famotidine 20 g. IV BID, change to PO when taking fluids  
|             | Diphenhydramine 25 mg. PO Q HS PRN sleep  
|             | Acetaminophen 650 mg. tabs PO Q4hrs PRN for mild pain 1-3/10. May give 1-2 tabs.  
|             | Colace 100 mg. PO BID when taking fluids.  
| IV          | D5.9NS @ 125/hr  
| Dietary     | Clear liquids advance as tolerated  
| Nursing     | Vital signs Q15min. x4, then Q30min. x2, then Q1hr. x 2, then Q4hrs.  
| Tubes/Drains | Jackson Pratt drain to bulb suction continuous. Record drainage every shift.  
| Incision    | Surgical dressing to remain intact. Surgical team will remove/assess. Breast binder.  
| Treatment   | Foley catheter to straight drain.  
|             | Pulse oximetry: spot check every shift  
|             | C&DB every 1hr. while awake; IS every 1 hr. while awake  
|             | Sequential compression devices while in bed  
| Oxygen      | O2 per nasal cannula, keep O2 sat > 92%  

Scenario 1 continued
Post Op Orders continued

Labs
- H&H in PACU
- CBC, platelet in AM
- Chem 7 in AM

Scenario 1

<table>
<thead>
<tr>
<th>State Events</th>
<th>Expected Nursing Student Behaviors</th>
<th>Faculty Facilitator</th>
</tr>
</thead>
</table>
| State 1      | • Introduce themselves to patient and family member and inform her of what the learner is going to do  
               • Check ID band to verify patient identity  
               • Perform a rapid assessment focusing on VS, Assess pain (etiology, location, character, intensity) and nausea; determine need for medications; ask patient to rate pain and nausea.  
               • Verify IV rate and assess IV site  
               • Check dressing; note drainage and reinforce  
               • Check fluid in JP drain | VS BP 129/89, P 110; RR 16, T 97.4  
Pulse ox 98%  
JP with 75 mL of sanguinous drainage.  
Dressing across the chest is saturated with bright red drainage.  
Complaining of pain 7/10 and nausea 7/10. States felt something “pop” after moved to bed. |
### Scenario 1 continued

<table>
<thead>
<tr>
<th>State Events</th>
<th>Expected Nursing Student Behaviors</th>
<th>Faculty / Facilitator &amp; Voice of mannequin</th>
</tr>
</thead>
</table>
| **State 1 cont.** | • Check fluid in foley  
• Document assessment findings, interventions, and responses  
• Review medication flow sheet or orders for pain med and nausea med.  
• Call physician regarding findings | |
| **State 2** | • Provide reassurance and explain plan of care.  
• Recognize that it is too soon to administer pain med; offer alternatives (darkened room, cool cloth, etc.).  
• Administer phenergan 12.5 mg. for nausea. Dilute per order.  
• Call physician regarding findings and need for additional orders | 1. Physician responds to call about dressing.  
am. Instructs to reinforce dressing until physician comes.  
b. Physician removes initial post-op dressing to evaluate incision. Finds 3 separated staples. Orders H&H x1 now, redress incision with sterile dressing, and Hydromorphone 2 mg. IVP x 1 for pain.  
2. If physician is not called, physician comes to unit and finds dressing saturated and JP with 75 mL drainage. |
### Scenario 1 continued

<table>
<thead>
<tr>
<th>State 2 cont.</th>
<th>Expected Nursing Student Behaviors</th>
<th>Faculty / Facilitator &amp; Voice of mannequin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Physician is annoyed and concerned at finding dressing is now saturated without being notified.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c. Orders H&amp;H x1 now, redress incision with sterile dressing, and Hydromorphone 2 mg. IVP x 1 for pain.</td>
</tr>
<tr>
<td><strong>State 3</strong></td>
<td></td>
<td>Pt. continues to complain of nausea pain. Starts retching.</td>
</tr>
</tbody>
</table>
| Following administration of hydromorphone | • Correct technique for sterile dressing.  
• Correct technique/tube for blood draw  
• Empties JP, records output  
• Reviews medication flow sheet or orders for pain med and nausea med.  
• Administers medications following the five rights  
• Safely administers IVP drugs  
• Checks site before attempting IVP administration  
• Sets up suction with yankauer tip.  
• Elevates HOB, provides pillow for splinting of incision. | Vital signs now: B/P 89/54, P 108, RR 12, T98, O2 sat. 87%.  
Pain level 4/10, nausea 3/10 if given promethazine. |
## Scenario 1 continued

<table>
<thead>
<tr>
<th>State Events</th>
<th>Expected Nursing Student Behaviors</th>
<th>Faculty / Facilitator &amp; Voice of mannequin</th>
</tr>
</thead>
</table>
| **State 3 cont.** | - Encourages C&DB or spirometry  
- Recognizes drop in B/P and increased HR  
- Recognizes decreased O2 saturation  
- Applies O2 per nasal cannula  
- Assesses effectiveness of pain med.  
- Assesses effectiveness of nausea medication  
- Notes no output since admission to unit and contacts physician/prescriber. | |
| **State 4** <br>Receive lab report: Hgb. 7.6 | - Hangs IV fluid bolus correctly  
- Reviews labs; recognizes low H&H and calls physician to report lab.  
- Gives physician last med administration times.  
- Recognizes improvement in VS in response to fluid bolus and O2 administration. | - Physician orders bolus of .9NS to infuse 500 mL over 60 minutes.  
VS: B/P 100/60, P 100, RR 14, T 98, O2 sat. 93%.  
Pain 3/10, nausea 2/10. States feels better.  
Physician orders transfusion of one unit packed red blood cells @ 100mL/hr. |
| **Hct 25** | - Break | - Put 50 mL urine in foley bag. |
Scenario 1 continued

<table>
<thead>
<tr>
<th>State Events</th>
<th>Expected Nursing Student Behaviors</th>
<th>Faculty / Facilitator Voice of the mannequin</th>
</tr>
</thead>
</table>
| **State 5**  |Obtains unit of PRBC, 250 mL 0.9 NS and blood administration set.  
Performs all patient and transfusion checks according to policy  
Designs and implements patient teaching plan related to blood transfusion  
Performs correct procedure for hanging blood transfusion.  
Closely monitors vital signs and symptoms first 15 minutes. | VS: B/P 125/82, P 90, RR 14, T 98  
O2 sat. 93%  
Breath sounds clear bilaterally  
Drowsy, oriented x3  
Patient rather quiet during transfusion procedures. Responding to student’s questions. |
| **State 6**  |Completes assessment, evaluates data, recognizes transfusion reaction cues, intervenes and documents.  
Closely monitors vital signs and symptoms  
Notes change in status and interprets data  
Immediately stops transfusion, disconnects tubing and flushes/clamps CVC port. | VS: B/P 90/60; P 120; RR 22; T 101.5  
O2 sat. 90% if O2 at 2L  
O2 sat. 92% if O2 at 4L  
Breath sounds clear bilaterally  
Oriented x 3; anxious |
Scenario 1 continued

<table>
<thead>
<tr>
<th>State Events</th>
<th>Expected Nursing Student Behaviors</th>
<th>Faculty / Facilitator Voice of mannequin</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>State 6 cont.</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>● Increases O2 delivery to 4L per minute per nasal cannula if not already at 4 L; increases to 6L if already at 4L</td>
<td>Tells learners when they inquire:</td>
</tr>
<tr>
<td></td>
<td>● Notifies physician/prescriber of change in condition</td>
<td>Complains of itching</td>
</tr>
<tr>
<td></td>
<td>● Follows protocol for transfusion reaction.</td>
<td>Hives with erythema present on back</td>
</tr>
<tr>
<td></td>
<td>● Notifies blood bank of potential reaction.</td>
<td>Restless</td>
</tr>
<tr>
<td></td>
<td>● Draws blood per policy</td>
<td>Tongue non-swollen</td>
</tr>
<tr>
<td></td>
<td>● Completes adverse blood reaction form</td>
<td>No c/o back pain.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prescriber Orders:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Diphenhydramine 25 gm IVP now</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Acetaminophen 650 mg PO x1 now</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increase O2 to 4L per nasal cannula</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Follow transfusion reaction policy.</td>
</tr>
<tr>
<td><strong>State 7</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete recovery</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>● Administers medication following the five rights into CVC that bolus is infusing into</td>
<td>102/58, P 94, RR 15, T 101.5</td>
</tr>
<tr>
<td></td>
<td>● Completes assessment, evaluates data, intervenes &amp; documents</td>
<td>Pulse ox 98% on 4L O2</td>
</tr>
<tr>
<td></td>
<td>● Closely monitors vital signs &amp; symptoms</td>
<td>Breath sounds clear</td>
</tr>
<tr>
<td></td>
<td>● Notes change in status; reports to healthcare provider.</td>
<td>Alert, oriented x3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pupils equal and reactive</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tongue, non-swollen</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tell learners when they inquire that itching is subsiding.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Debrief following debriefing protocol.</td>
</tr>
</tbody>
</table>
Scenario 2: Care of Acute MI, Management of Cardiogenic Shock


Scenario Description

This simulated clinical experience was designed to expose the learner to a rapidly changing clinical situation by exposing the learner to hemodynamic changes caused by impaired cardiac function secondary to Acute Myocardial Infarction. The learner will need to call the healthcare provider to report hemodynamic instability and will need to make decisions about following the orders provided. The simulation will be completed as the patient is transported back to the cardiac catheterization lab. All hemodynamic changes will be automatic.

Simulator Set Up Notes

- Dress in hospital gown and position supine and flat throughout the simulation
- Apply dressing with elastic tape to right groin, create 2 cm diameter dark red drainage
- RAC IV infusing 1000 mL 0.9% NS via an infusion pump at 75mL/hour
- CVC right internal jugular, distal port infusing IntegriLin drip 75000mcg/100mL In D5W at 2mcg/kg/min per infusion pump
- CVC medial port infusing Heparin 25000units/250mL 0.9% NS at 12 units/kg/hour infusion pump
Scenario 2 continued

Supplies:

IV
- IV in RAC
- CVC with drain
- Sterile water 1000mL (label 0.9%NS)
- Triple lumen CVC
- Transparent dressing
- Nitroglycerine tubing
- IV primary and secondary tubing
- 3 channel infusion pump

Blood Collection
- Various blood collection tubes
- Luer lock access device (blue tip) for CVC blood draws
- Prefilled saline syringes
- 10mL syringes
- Alcohol preps
- Biohazard bags
- Labels and blood tube guide

Oxygen
- Nasal cannula and non-rebreather mask
- Wall flowmeter

Suction
- Yankauer suction tip
- Suction collection canister and Suction tubing
Scenario 2 continued

Supplies continued

Medications
Simulated IV medication bags labeled:
Sterile water 250mL (2 label D5W with nitroglycerine 50mg)
Sterile water 250mL (label D5W dobutamine 250mg)
Sterile water 100 mL (label D5W eptifibatide 75,000mcg)
Sterile water 250mL (label 0.9% NS with heparine 25,000 units)

Simulated medication bottles labeled:
Simvastatin 40 mg
Aspirin EC 325mg
Ramipril 5mg
Metoprolol 25mg
Clopidogrel 75mg
Glipizide 5mg

Simulated medication vials labeled:
Promethazine (Phenergan)
Diphenhydramine (Benedryl)
Acetaminophen (Tylenol) 325 mg
Nitroglycerine 0.4mgtablet SL
Midazolam 1mg/mL
Heparin 5000 units/mL
Prefilled syringe (labeled morphine 1mg/mL)
3mL syringes, 10mL syringes, 10mL prefilled syringes.
Scenario 2 continued

Supplies continued

<table>
<thead>
<tr>
<th>Category</th>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dressing</td>
<td>Folded 2x2 dressing</td>
</tr>
<tr>
<td></td>
<td>Tegaderm</td>
</tr>
<tr>
<td></td>
<td>2 inch elastic tape</td>
</tr>
<tr>
<td></td>
<td>A drop of red colored water</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>Hospital gown</td>
</tr>
<tr>
<td></td>
<td>Bedside telephone</td>
</tr>
<tr>
<td></td>
<td>ID band with correct name, DOB and MRN</td>
</tr>
<tr>
<td></td>
<td>Stethoscope</td>
</tr>
<tr>
<td></td>
<td>B/P cuff adapted for use with simulator</td>
</tr>
<tr>
<td></td>
<td>Non-sterile gloves</td>
</tr>
<tr>
<td></td>
<td>Hazardous waste disposal box</td>
</tr>
<tr>
<td></td>
<td>12-lead ECG machine</td>
</tr>
<tr>
<td></td>
<td>Code cart with defibrillator</td>
</tr>
<tr>
<td></td>
<td>Over bed sign “Patient is Blind”</td>
</tr>
<tr>
<td></td>
<td>Urinal</td>
</tr>
<tr>
<td></td>
<td>White board and dry erase markers, eraser</td>
</tr>
<tr>
<td></td>
<td>Laptop computers, A/C adapters, extension cords</td>
</tr>
<tr>
<td></td>
<td>Student role badges with approved roles</td>
</tr>
<tr>
<td></td>
<td>Videotaping equipment (Optional)</td>
</tr>
<tr>
<td>Documents</td>
<td>Observer checklists and TLC simulation reset instructions</td>
</tr>
<tr>
<td></td>
<td>SBAR communication tool, copies of scenario, and post procedure orders</td>
</tr>
<tr>
<td></td>
<td>Med drip calculation chart</td>
</tr>
</tbody>
</table>
Scenario 2 continued

History/Information

Mr. James is a 48 year old blind male who has a past medical history significant for hypertension, non-insulin dependent diabetes and coronary artery disease. He smoked two and a half packs of cigarettes per day but recently quit. He had coronary stents in the past year. He has a positive family history including his father who died of congestive heart failure recently. His mother had a coronary artery bypass graft at age 50. Upon annual routine follow up, he failed his cardiac stress test. He was taken directly to the cath lab and underwent diagnostic cardiac catheterization and was found to have significant coronary artery disease requiring stent placement. Two coronary stents were placed. One was placed in the mid left anterior descending artery and the other was placed in the proximal circumflex artery. While in the cath lab Mr. James was given aspirin 324mg (4 baby aspirin) to chew and clopidogrel 300 mg. Mr James is status post percutaneous transluminal coronary angioplasty (PTCA) 2 hours ago and is admitted for overnight observation on the progressive care unit.

Report from PPRC nurse:  Mr James is a 48 yo blind male, 2 hrs. post cath after being sent to the cath lab after failing a routine stress test for previous stent placement. He has multiple risk factors and family history of CAD. He was an emergent PTCA. His mid LAD was 90% occluded and his proximal circumflex was 75-80% occluded. He had two stents placed, one was placed distally to the original stent in the mid left anterior descending artery and the other was placed distal to the previous stent in the proximal circumflex artery. Sheath was removed from right groin and angioseal was placed. Pt. has strong pedal pulse. IV of 0.9% NS infusing at 75 mL/hr. in RAC. CVC inserted in right IJ and placement confirmed. Eptifibatide (Integrilin) loading dose of 180 mcg/kg (8mL) and 180 mcg/kg (8mL) 10 min after initial bolus. Eptifibatide (Integrilin) drip 75000mcg/100mL infusing in distal port of CVC at 2mcg/kg/min. Heparin bolus of 5000 units given and Heparin 25000 units/250mL of 0.9% NS infusing in medial port at 12 units/kg/hr. Monitor shows normal sinus rhythm. VS: BP 116/62, HR 80, RR 16, SpO2 99% on room air. He has had no urine output. Baseline labs are Hgb 13.9, Hct 42, WBC 7, Na 137, K 4.1, glucose 72, PT 12.4, PTT 30, INR 1.0, CK 100, CKMB <4, Troponin I 0.04 Pt is awake and alert. Denies chest pain. Slight discomfort in groin. Family is in unit waiting room.
Scenario 2 continued

Post Procedure Orders

Activity
May elevate HOP < 30 degrees. Keep right leg straight.

Procedures
PRN STAT 12-lead ECG for chest pain

Crystalloids
0.9% NS 1000mL at 75mL/hour

Diet
Diabetic 1800 Kcal, sodium restricted no added salt (3GM) low cholesterol

IV
Heparin 25,000 units/250mL 0.9 NS at 12 units/kg/hr medial port CVC
Eptifibatide 75000 mcg/mL in 100 mL at 2 mcg/kg/min

Labs
PT/PTT PRN Q6hrs while on heparin drip
PT/PTT q 6 HRS
CBC Q 8H x1
Chem 7 Q8H x1

Med Instructions
Heparin titration PRN PTT 123: Hold drip for 60 minutes, notify house officer, and decrease rate by 4 units/kg/hr
Heparin titration PRN PTT 106-123: Hold drip for 30 minutes and decrease rate by 2 units/kg/hr
Heparin titration PRN PTT 85-105: Decrease rate by 1 unit/kg/hr
Heparin titration PRN PTT 68-84: NO CHANGE - THERAPEUTIC
Heparin titration PRN PTT 57-68: Increase drip 1 unit/kg/hr
Heparin titration PRN PTT < 578: Increase drip by 2 units/kg/hr
Scenario 2 continued

Post Procedure Orders continued

Medications
- Eptifibatide (Integrilin) IV 8mL x2. Give 180 mcg/kg from 2mg/mL vial prior to integrilin infusion. Repeat 10 min after loading dose, then start drip at 2 mcg/kg/min.
- Nitroglycerine 0.4mg table SL every 5 minutes PRN may repeat x3 for chest pain
- Acetaminophen (Tylenol) 325 mg PO Every 6 hours PRN, give 2 tabs for mild pain.
- Diphenhydramine (Benedryl) 25 mg PO QHS PRN for sleep
- Promethazine (Phenergan) 12.5 mg IV Q4H PRN nausea
- Glipizide 5 mg PO daily
- Clopidogrel 75mg PO daily
- Metoprolol 25mg PO Q 12H
- Ramipril 5mg PO daily
- Aspirin EC 325mg PO daily
- Simvastatin 40mg PO daily

Nursing
- Notify physician if SBP >180, or <90, DBP >90 or <60; HR >120 or <60; RR>24, or <8; T > 101.5; Urine output <30mL/Hr; O2 sat < 92%
- Notify physician: If post procedure complications, bleeding complications, hemodynamic instability, chest pain, shortness of breath.
- Straight cath x2 PRN if unable to void
- Neurovascular check to right lower extremity Q15minutes x4, then Q30 minutes x2, then Q1 hour x1, then Q4H
- CVC assess Q8H triple lumen

O2 Therapy
- Nasal cannula 2L PRN for chest pain
Scenario 2 continued

Post Procedure Orders continued

Treatments
Cardiac monitoring continuous
VS Q15 min×4, then Q30 min×2, then Q1Hx2, then Q4 H
Fingerstick glucose before each meal and bedtime

Vascular Access
Peripheral IV RAC
CVC right IJ

Incision/Wound Care
Check right groin dressing site for bleeding and check affected limb for angioseal site
every 15 minutes x4, every 30 minutes x2, every hour x1, then Q4H.

Scenario 2

<table>
<thead>
<tr>
<th>State Events</th>
<th>Expected Nursing Student Behaviors</th>
<th>Faculty / Facilitator Voice of Mannequin</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>State 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Two hours post-procedure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECG Results in CIS – 12-lead ECG: sinus tachycardia with ST elevations in the anterior leads.</td>
<td>● Identifies self to patient and informs him of what the learner is going to do&lt;br&gt;● Checks ID band to verify patient identity&lt;br&gt;● Completes post procedure assessment, interprets findings and documents</td>
<td>HR: 108&lt;br&gt;BP: 110/66&lt;br&gt;RR: 24&lt;br&gt;Sp O2: 99%&lt;br&gt;Breath sounds: Clear&lt;br&gt;Heart Rhythm: Sinus tachycardia&lt;br&gt;Anxious&lt;br&gt;Complains of chest pain 8/10</td>
</tr>
</tbody>
</table>

Continued
## Scenario 2 continued

<table>
<thead>
<tr>
<th>State Events</th>
<th>Expected Nursing Student Behaviors</th>
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</tr>
</thead>
</table>
| **State 1 continued**   | • Interprets cardiac rhythm  
                          • Ensures that IV fluid is infusing at correct rate  
                          • Monitors the pump and patient frequently to ensure correct operation, flow rate, and early detection of infiltration  
                          • Administers first and second nitroglycerin SL at 5 minute intervals  
                          • Reassesses and interprets findings  
                          • Obtains or delegates 12-lead ECG to appropriate personnel  
                          • Notifies healthcare provider of chest pain unrelieved by nitroglycerine  
                          • Completes reassessment after each nitroglycerin administration  
                          • Explains all procedures before implementing  
                          • Takes measures to alleviate patient’s anxiety | Peripheral pulses palpable  
                              Groin dressing with 2cm drainage, dry, intact  
                              No U/O since back from cath lab |
### Scenario 2 continued

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</tr>
</thead>
<tbody>
<tr>
<td><strong>State 2</strong></td>
<td>• Obtains new set of vital signs</td>
<td>BP: 100/58 HR: 111 Pain increases to 10/10</td>
</tr>
<tr>
<td>After 2 Nitroglycerin SL Administration</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The healthcare provider arrives at bedside. Can be role-played by second faculty member or primary faculty member.

Healthcare Provider’s Orders: (Diagnosis: cardiogenic shock)

STAT CPK with isoenzymes, troponin 1 then every 6 hours x2, PTT, BUN, creatinine now.

Give 500mL bolus 0.9%NS over 30 minutes

Nitroglycerine infusion 50mg/250mL D5W, start at 10mcg/minute Titrate upwards 5-10 mcg/minute at 5 min. intervals until patient is chest pain free

**Continued**
### Scenario 2 continued

<table>
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<tbody>
<tr>
<td><strong>State 3</strong></td>
<td>- Performs vital signs prior to the start of nitroglycerin infusion</td>
<td>BP 94/52</td>
</tr>
<tr>
<td>Decompensated cardiac function</td>
<td>- Recognizes ECG changes and counts premature ventricular contractions (PVC) per minute</td>
<td>HR 122</td>
</tr>
<tr>
<td>Lab results:</td>
<td>- Recognizes minimal U/O</td>
<td>RR 28</td>
</tr>
<tr>
<td>CPK 150, CK-MB 10</td>
<td>- Inserts urinary catheter using aseptic technique</td>
<td>SpO2: 90%</td>
</tr>
<tr>
<td>Troponin1: 1.0</td>
<td>- Stops heparin drip due to elevated PTT according to protocol</td>
<td>Breath sounds: crackles at bases bilaterally</td>
</tr>
<tr>
<td>BUN 20</td>
<td>- Notifies healthcare provider of changes in assessment</td>
<td>Heart Rhythm: Sinus tachycardia with unifocal premature ventricular contractions</td>
</tr>
<tr>
<td>Creatinine 1.3</td>
<td>- Administers medication following the five rights</td>
<td>Diaphoretic</td>
</tr>
<tr>
<td>PTT 110</td>
<td>- Student should check the site before attempting IVP administration</td>
<td>Complains of unrelenting chest pain, 10/10, now radiates to left side of jaw and left arm.</td>
</tr>
</tbody>
</table>

Continued
Scenario 2 continued

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</tr>
</thead>
<tbody>
<tr>
<td>State 3 continued</td>
<td>- Initiates nitroglycerin drip&lt;br&gt;- Delegates lab work to the appropriate personnel&lt;br&gt;- Seeks and interprets results of lab tests&lt;br&gt;- Explains all procedures before implementing</td>
<td>U/O &lt; 30 mL/H&lt;br&gt;Increasing anxiety</td>
</tr>
</tbody>
</table>

Healthcare Provider’s Orders (Post procedure 2)

- Notify cardiac catheterization lab that patient needs to return
- Consult interventionalist: pt. restented is now having severe chest pain
- CBC now
- PTT 1 hr. after drip stopped. Follow weight based heparin sliding scale
- Morphine 4 mg IVP q3H pm chest pain
- Dobutamine 250 mg/in 250 mL D5W at 5 mcg/kg/min, (27 mL/hr, infuse in proximal prot)
- Oxygen 100% non-rebreather mask

Continued
**Scenario 2 continued**

<table>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>State 4</strong></td>
<td><strong>Cardiogenic shock</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>● Notifies lab of orders</td>
<td>HR: 180</td>
</tr>
<tr>
<td></td>
<td>● Administers medications following the five rights</td>
<td>B?: 70/50</td>
</tr>
<tr>
<td></td>
<td>● Begins dobutamine infusion via pup at correct rate</td>
<td>RR: 28</td>
</tr>
<tr>
<td></td>
<td>● Reassesses pain after medicating</td>
<td>SpO2: 93% on 100% oxygen</td>
</tr>
<tr>
<td></td>
<td>● Recognizes change in heart rhythm and reports to healthcare provider</td>
<td>Breath sounds: crackles</td>
</tr>
<tr>
<td></td>
<td>● Applies non-rebreather at 100% oxygen</td>
<td>Heart Rhythm: Atrial fibrillation with rapid ventricular response</td>
</tr>
<tr>
<td></td>
<td>● Notifies cardiac catheterization lab that patient will be returning</td>
<td>Complains of chest pain 8/10, increasing pain in jaw and left arm</td>
</tr>
<tr>
<td></td>
<td>● Obtains 12-lead ECT</td>
<td>Increasing anxiety</td>
</tr>
<tr>
<td></td>
<td>● Obtains code cart</td>
<td>If oxygen flow meter is not turned up to 15 liters, do not increase the SpO2</td>
</tr>
</tbody>
</table>

**Healthcare Provider’s Orders (Cardioversion)**

Midazolam 5mg IV PRN prior to cardioversion. Do not administer until physician present.

Cardiovert with 50J as needed for tachyarrhythmia with hemodynamic instability.
Scenario 2 continued

<table>
<thead>
<tr>
<th>State Events</th>
<th>Expected Nursing Student Behaviors</th>
<th>Faculty / Facilitator Voice of mannequin</th>
</tr>
</thead>
</table>
| **State 5** Cardioversion           | ● Assesses cardiac rhythm  
   ● Explains procedure to patient before implementing  
   ● Safely cardioverts patient with 50J  
   ● Notifies cardiac catheterization lab that patient will be returning (if not already done) | Patient is under conscious sedation: is sleepy but responds to questions  
   Click post-cardioversion state at exact time of first shock |
| **State 6** Post cardioversion and prep for cath lab | ● Assesses cardiac rhythm  
   ● Reassesses patient and interprets findings  
   ● Prepares for transport to Cardiac Catheterization Lab  
   ● Ensures that documentation is current  
   ● Reports accurately to Cardiac Cath Lab. | HR: 105  
BP: 90/50  
RR: 28  
SpO2 94% on non-rebreather  
Breath sounds: crackles  
Heart Rhythm: sinus tachycardia with 10% PVCs  
Continues to complain of chest pain, unchanged  
Anxious |


**Scenario 2 continued**

**Discussion Questions**

1. What is the desired effect of nitroglycerine?
2. How does nitroglycerine achieve this reduction of chest pain?
3. Why is nitroglycerine given 5 minutes apart?
4. What do the patient’s signs and symptoms indicate?
5. What would the nurse look for when assessing the groin insertion site?
6. What neurovascular symptoms would the patient complain of if the nurse identifies a weak thready distal pulse of the right foot?
7. What action should the nurse take when the patient exhibits decreased circulation to the leg with the angioseal?
8. What considerations would the nurse gather in deciding which position this patient should be placed in?
9. What changes in communication should the nurse make when caring for a patient who is blind?
10. Explain the pathophysiology for the crackles and frequent PVCs.
11. What is the rationale for giving heparin?
12. Why is the oxygen increased to 100%?
13. What is the difference between cardioversion and defibrillation?
14. How will cardioversion change the patient’s condition?
15. What is important to remember about the defibrillator when cardioverting?
16. Why is the immediate return to the cardiac cath lab a priority?
17. Pharmacology discussions
   - Use of Dopamine. VS Norepinephrine. VS Dobutamine
   - Rationale for holding Glipizide
   - Impact of drug diluting; VS metal stents and medications.
   - Use of Integrisin. VS Heparin.
Scenario 2 continued

References


Scenario 2 continued


Scenario 3: Cardiac Arrest Anticipation and Management: When is it Time to Worry?

Authored By: Paula Garvey MSN-ED, RN-BC, Program Manager – Simulation and Continuing Nursing Education, Center for Nursing Practice, Education & Research, The Ohio State University and Auxiliary Faculty, The Ohio State University College of Nursing. Adapted with permission from the author.

**Background:** The learner is coming on to work the 7P – 7A shift. The learner will receive report from a very busy off-going nurse who has been overwhelmed with a couple of admissions and a critical patient who is getting blood and blood products for a GI bleed with hypotension. The report is very sketchy, hurried. The offgoing nurse is unsure of a lot of details because she only stuck her head in the room to hook him to telemetry and see if he needed anything.

**Report:** This is Mr. B. He’s a 63 year old and obese at 260#. He presented to the ED this morning with complaints of a flu-like illness with fever, chills, malaise, N/V/D. He stated that he just can’t keep anything down for the past few days. He also has a cough for a week with this thick, brown, nasty sputum which was sent for culture.

His medical history includes COPD. He is a two-pack a day smoker for 40 years. He had an MI 3 years ago and got a CABG to the LAD and RCA. His EF is 25%. No allergies. He’s on Plavix, Nitro prn, and Lopressor.

He has an 18g IV in the left AC which is a saline lock. They drew all the usual labs, but they weren’t back before they transferred him up here. They did a chest film that showed CHF, so he got Lasix 40mg IV at 11:30 and they placed a foley (100mL dark urine is in the foley bag). I don’t think the PCA emptied it yet, so what’s in there is yours from the ED. He got here around 3:00. I stuck my head in and hooked him to tele and checked the IV and everything was fine. He didn’t have any complaints. He was grouchy though, and asked me the same thing about
Scenario 3 continued

10 times. I definitely didn’t have time for that. As nurse is backing out of the room…..”If you don’t have any more questions, I’ve really got to run because my 10 minutes are up and I’ve got to do blood vitals. Have a good night.”

Scenario

State 1
Vital Signs: Tachycardia with ST segment elevation. HR 108-100 bpm; BP 104/70; RR 28; O2 sat 88%.

- As learner is assessing, the heart rhythm becomes more unstable with the addition of PVCs.
- The BP begins to decrease (slow drop and leveling off around 76/36.
- O2 sat drops to 85% with cyanosis and mental confusion

Mr. B (continuous complaining, anxious, mildly confused): “My chest hurts. I can’t catch my breath – it hurts to breathe. I just don’t feel good.” (He complains enough that it should be obvious when he eventually quits talking and becomes unresponsive.)

The learner should begin to assess Mr. B. Key points: Rapid physical assessment of chest pain and respiratory distress, vital signs, brief history, recognize signs of MI and cardiogenic shock, call for help (charge nurse, MD or ERT). Should be prepping for 12-lead ECG, obtain lab values, IV access, oxygen, rhythm and hemodynamic support.
Scenario 3 continued

If the learner calls the MD, the prescriber gives orders for STAT 12-lead ECG, inquires about labs, assessment, vitals.

**Physician Orders:** STAT ABG then start on 4L oxygen by nasal cannula. Give 1 Nitroglycerine SL, then repeat Q5 minutes x2 and give Morphine 4mg if BP > 100 systolic.

If learner does not have all the needed information before calling, the prescriber is a little annoyed that they called prematurely without all the physical assessment and lab data.

The physician comes to the unit shortly.

**State 2**

The telemetry is now showing ST with runs of V tach
O2 sat. 80%
Mr B is unresponsive

The learner should call the code, begin CPR, bring in crash cart, apply patches, defibrillate. MD arrives and asks for the events that have happened prior to the code; The MD runs the code, directing CPR, bagging, defibrillation, Epinephrine 1 mg IV, then 2 minutes later after next shock MD orders Amiodarone 300 mg IV.
Scenario 3 continued

Code Sequence:

- CPR
- Defibrillate x1
- Epinephrine 1mg
- CPR x 2 minutes
- Defibrillate x1
- Return to sinus bradycardia that increases up to sinus rhythm with PVCs
- O2 sat returns to 93%
- Amiodarone 150mg IV

State 3

Mr B is stable
MD orders an Amiodarone drip at 1mg/min
Place patient on 100% non-rebreather mask
Redraw labs
12-lead ECG
Transfer patient to ICU
Scenario 3 continued

Lab Report

<table>
<thead>
<tr>
<th>Lab Test</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td>155</td>
</tr>
<tr>
<td>Potassium</td>
<td>6.3</td>
</tr>
<tr>
<td>Chloride</td>
<td>108</td>
</tr>
<tr>
<td>CO2</td>
<td>55</td>
</tr>
<tr>
<td>BUN</td>
<td>25</td>
</tr>
<tr>
<td>Creatinine</td>
<td>2.5</td>
</tr>
<tr>
<td>WBC</td>
<td>20,000/mm³</td>
</tr>
<tr>
<td>Hemoglobin</td>
<td>7g/dl</td>
</tr>
<tr>
<td>Hematocrit</td>
<td>35%</td>
</tr>
<tr>
<td>Platelets</td>
<td>250,000/mm³</td>
</tr>
<tr>
<td>pH</td>
<td>7.29</td>
</tr>
<tr>
<td>PaCO₂</td>
<td>65</td>
</tr>
<tr>
<td>HCO₃</td>
<td>22</td>
</tr>
<tr>
<td>PaO₂</td>
<td>75%</td>
</tr>
<tr>
<td>SaO₂</td>
<td>78%</td>
</tr>
</tbody>
</table>

12-Lead ECG Report: ST segment elevation leads II, III, aVF and V1-V4
Scenario 4: Sepsis Recognition and Management: When is it Time to Worry?

Authored By: Paula Garvey MSN-ED, RN-BC, Program Manager – Simulation and Continuing Nursing Education, Center for Nursing Practice, Education & Research, The Ohio State University and Auxiliary faculty, The Ohio State University College of Nursing and Debbie Francis, CNS MS RN, Meg-Surg Administration, Ohio State University Medical Center. Adapted with permission from the author.

Background

Learner has just received report on the patient that is a 63 y.o. obese male admitted to the unit at 0600am from the ER with a diagnosis of abdominal pain. Past medical history: Asthma, Obstructive Sleep Apnea, Type 2 Diabetes, 2PPD Smoking x 20 years, and a remote hx of Alcohol Induced Pancreatitis. During the past week, he has been experiencing anorexia, nausea, vomiting and a low grade fever. Currently he is anxious, restless, pale in color, and complaining of pain throughout his abdomen subjectively rating 9/10.

Report from nurse.

VS were stable in the ER and they gave him 1 mg of IV Dilaudid at 3am which provided some relief. Labs from ED (Chem 10 – Na 142, K 4.5, Cl 105, CO2 31, Bun 33, Cr. 2.0, Glucose 270) LFT’s pending and CBC with diff was repeated with am labs. ED sample was lost. Abdominal CT report is unremarkable.
Scenario 4 continued

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Physician Orders</th>
<th>Patient Response</th>
<th>RN Key Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>0730</td>
<td>VS on unit: Temp 98, BS 220 BP 110/70 HR 101, RR 22 Sat 92% on room air Patient complaining of pain 8/10 (if learner asks about pain) No documented urine output since arrival to unit (1.5 hours ago)</td>
<td>If physician is called, physician states: “the patient should already have something ordered for pain…go ahead and medicate him, he may be a drug seeker, I am not sure yet.”</td>
<td>Focus is on pain and how bad it hurts…requesting pain medication. States, “Help me; this is not getting any better.”</td>
<td>Perform head to toe assessment Medicate for pain Reassess anytime after 10 minutes for pain relief.</td>
</tr>
</tbody>
</table>

- Assessment is unremarkable except for generalized abdominal tenderness
- Dilaudid order available

Continued
Scenario 4 continued

<table>
<thead>
<tr>
<th>Time</th>
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<th>Patient Response</th>
<th>Key RN Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>0815</td>
<td>Patient calls out again with c/o “my pain is worse!!!”</td>
<td>Intern covering answers when RN calls. “Give Dilaudid 2 mg IV now. “I will be up to see him as soon as I can.”</td>
<td>Increased anxiety over pain. States: “What you gave me before was no good…I need more! Call the doctor.”</td>
<td>Pain assessment with rating 10/10 Additional assessment, inquires r/t pt. c/o pain being worse…taking with pt. comforting, explaining what is going on. Notifies physician of abnormal findings of increased pain, not relieved with medication, and increased heart rate.</td>
</tr>
</tbody>
</table>

HR 115
Sat 92%
BP 140/90
Pain 10/10 (reported when RN assesses)

Focus is on increased pain

Continued
### Scenario 4 continued

<table>
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<tr>
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<th>Key RN Actions</th>
</tr>
</thead>
</table>
| 0900  | HR 120, RR 26, O2 Sat 90%, BP 120/76 | “What are his O2 sat and B/P?”
I will be there soon…I am admitting a patient on another unit.
Start him on oxygen 2L nasal cannula. | Patient does not seem as focused on his pain…anxiety continues.
Some noted SOB | Reassesses, heart, lungs, pain level, talking with patient/comforting, explaining what is going on.
Inquires r/t pending labs
Calls physician r/t increased HR, increased RR and Decreased O2 Sat. Increases chain of command?
Facilitates getting bedside monitor
Inquires r/t CBC |
Scenario 4 continued

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<th>Key RN Actions</th>
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<tbody>
<tr>
<td></td>
<td>CBC and LFT’s are pending. Focus is on patient being anxious, with some SOB and the steps to take if physician response is not what it should be for the patient status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CBC comes back if requested by RN. (WBC 14, RBC 3.7, HG 11.90, Hct 32.8 Plt 398)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>0930</strong></td>
<td>Pt. calls out, “I wondered if you could tell me where I am?”</td>
<td>What is his B/P?</td>
<td>Reports still is not feeling “right,” but pain is better.</td>
<td>Calls different physician (report includes change in mental status)</td>
</tr>
<tr>
<td></td>
<td>Labs WBC 14</td>
<td>Has he had any urine output?</td>
<td>Confused on and off U/O 75mL</td>
<td>Calls ERT</td>
</tr>
<tr>
<td></td>
<td>HR 120</td>
<td>Orders foley catheter and Bolus of NS IV 500cc</td>
<td></td>
<td>Reassesses &amp; takes additional VS (temp)</td>
</tr>
<tr>
<td></td>
<td>RR 26</td>
<td></td>
<td></td>
<td>Inquires about pending labs</td>
</tr>
<tr>
<td></td>
<td>O2 Sat 90%</td>
<td></td>
<td></td>
<td>Facilitates getting bedside monitor</td>
</tr>
<tr>
<td></td>
<td>BP 104/70</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Still no void</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Continued
Scenario 4 continued

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Physician orders</th>
<th>Patient Response</th>
<th>Key RN Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1030</td>
<td>Patient yells out, “Get me out of here. You are all crazy!” O2 at 2L nasal cannula HR 128 BP85/40 RR 30 T 102 O2Sat 88%</td>
<td>50% Venti Mask .9 NS 1L bolus Blood cultures Lactate level Vancomycin 1 gm IV after blood cultures.</td>
<td>Pt anxious and restless, starting to get agitated. Complaining of difficulty breathing</td>
<td>If ERT was NOT called, patient starts decompensating fast and scenario progresses to a code scenario r/t ectopy, vfib, &amp; shock. Patient returns to successful rhythm after code resuscitation.</td>
</tr>
</tbody>
</table>
Scenario 4 continued

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Physician Orders</th>
<th>Patient Response</th>
<th>Key RN Actions</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
<td></td>
<td></td>
<td>If ERT has been called:</td>
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<tr>
<td></td>
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<td></td>
<td></td>
<td>RN reassesses</td>
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<td></td>
<td></td>
<td>Checks VS</td>
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<td></td>
<td>Inquires about ABG,</td>
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<td></td>
<td>Chest X-ray,</td>
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<td></td>
<td></td>
<td>antibiotics, lactate,</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>ore volume, more</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>O2, blood cultures.</td>
</tr>
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<td></td>
<td></td>
<td>RN successfully</td>
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<td></td>
<td>moves up chain of</td>
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<td></td>
<td>command to bring</td>
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<td></td>
<td>more resources to</td>
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<td></td>
<td></td>
<td>change in patient</td>
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<td></td>
<td></td>
<td>status.</td>
</tr>
</tbody>
</table>

Debrief: Discuss early recognition of declining patient status. Review signs of sepsis. Discuss utilization of emergency response team (ERT) and moving up physician and nursing chain of command to bring more resources to patient in response to changing status. Review code sequence and standards of care.
Appendix D: Institutional Review Board Approval Letters
The Behavioral and Social Sciences Institutional Review Board
Office of Responsible Research Practices
Ohio State University, Columbus, OH 43210

April 27, 2011

Protocol Number: 2011060077
Protocol Title: THE NATURE OF PRESENCE OF NURSING STUDENTS PARTICIPATING IN HIGHER-ORDER HUMAN PATIENT SIMULATION, R should be redacted
Rebecca
Dunne, 
Foundation

Type of Review: Initial Review
IRB Staff Contact: Jason R. Cline
Phone: 614-292-6176
Fax: 614-292-6756

Dear Dr. Velho,

The Behavioral and Social Sciences IRB APPROVED EXPEDITED REVIEW the above-referred research. This
Research Board was able to provide expedited approval under 45 CFR 46.104(D)(1) because the research meets the applicability
criteria andacci and assumes all risks in accord with this IRB's approved procedures, as indicated below:

Date of IRB Approval: April 27, 2011
Date of IRB Approval Expiration: February 28, 2012
Expediting Review Category:

If applicable, informed consent and IRB approval must be obtained from subjects or their legally authorized
representatives and documented prior to research involvement. The IRB-approved consent form and procedures must be used.
Changes in the protocol (e.g., recruitment procedures, advertisements, enrollment numbers, etc.) necessitate an amendment
process. The amendment must be approved by the IRB before it is implemented. (except where necessary to determine patient immediate risk to
subject)

This approval is valid for one year from the date of IRB review when approval is granted by
modifications are requested. The approval will be supported by a reflection that (a) the study is reviewed by the IRB and (b) the study is registered. A Continuing
Review application must be approved within 30 days of the next review cycle. If this approval is extended, a final
approval must be due to the IRB and all records, including the research (including but not limited to consent forms) must be retained
for at least 1 year from the date the research has ended.

Irrespective of all investigators and research staff, immediately report to the IRB any serious, unexpected and related
adverse events and potential unnecessary problems involving the study's subjects.

This approval is issued under the Ohio State University's IRB Federal Assurance #0700978.

All forms and procedures can be found on the ORPR website - www.orpr.osu.edu. Please feel free to contact the IRB staff
with any questions or concerns.

Sami K. Sober, Ph.D. Chair
Behavioral and Social Sciences Institutional Review Board
IRB - Exempt Approval

April 26, 2011

Renee Dunnington, MSN, RN
Assistant Professor, School of Natural Science Nursing & Health
Capital University
1 College & Main
Columbus, OH 43209

RE: The Nature of Presence of Learners Participating in High Fidelity Human Patient Simulation
IRB # OH1-11-00245

Dear Ms. Dunnington:

The above-referenced protocol has been deemed exempt from Institutional Review Board (IRB) review under the provisions of 45 CFR 46.101(b)(2). No risks will accrue to research subjects. No names or other identifiers will be recorded in the research records.

Please keep in mind that reports in journals or at meetings should involve only aggregate and anonymous information. As Principal Investigator of this protocol, it is your responsibility to keep all necessary documentation pertaining to the study. If you decide that you need to make changes to your study, you must contact the IRB office at (614) 566-5319 or submit a revised protocol to the IRB in order to re-evaluate the study’s review status.

Thank you for submitting your proposal to the OhioHealth IRB for consideration.

Sincerely,

James W. Lewis, MD
Chairman, OhioHealth IRB #1
Renee Dunnington, MSN, RN
Department of Nursing
Capital University
Columbus, OH 43209

February 7, 2011

Dear Ms. Dunnington,

This is to confirm the approval for one year of your IRB protocol proposal #11-02-01
(Dunnington and Voithofer): "The Nature of Presence in Learners Participating in High Fidelity
Human Patient Simulation." The protocol proposal, as appropriately modified, was approved on
January 24, 2011, by Expedited Review.

Sincerely,

[Signature]
Peter Horn, Ph.D.
Chair, Institutional Review Board
Capital University
Kerns 300
1 College and Main Streets
Columbus, OH 43209
Appendix E: Recruitment Script
RECRUITMENT SCRIPT

Study Title: The Nature of Presence in High Fidelity Human Patient Simulations in Nursing Students.

Researcher: Rick Voithofer PhD
Renee Dunnington MSN RN

Script:

I am happy to visit your class/lab this morning /afternoon to tell you about our research concerning the student experience with human patient simulation. The purpose of this study is to explore the nature of the learning experience with human patient simulation. Information from this study may help to further understand factors that may impact the learner’s experience and to support future instructional design of simulation laboratory experiences that may improve learning outcomes.

If a student….
As a normal and required part of your class/lab you will be participating in one or more simulations. But this study is not a requirement for the class that you are taking and does not affect your outcome or evaluation in this class.

If faculty or staff…..
As a normal part of the course/lab that you are involved in, you are normally assisting students in simulations. This study will not alter the simulation learning experience or your ability to coach or evaluate students during the simulation.

If you decide to participate in this study, in addition to your normal routine of attending your assigned simulation labs for this class, as a participant in this study, a researcher will observe your simulation lab and you may be asked to complete either a group or an individual interview. If you are asked to complete an individual interview following your simulation lab, the researcher will arrange a mutually convenient time and place. The group interview will be conducted during the normal simulation debriefing time. The interview will be questions about the learning experience in the simulation. The interview should take approximately 1 – 2 hours to complete. The observations of the simulations may be video recorded for researchers to analyze later. The interviews will be audio recorded for the researchers to analyze later.
If you participate in an interview, you will be asked to provide some demographic information such as age, ethnicity and gender; but no personal or uniquely identifying information will be collected. You or the researcher will create a unique identifier code to link the interview with the simulation for this study. This code will be known only by you and the investigators in the study. Your identity will not be disclosed or reported in any report of findings or publications from this study.

If you participate in an interview for this study, in appreciation of your time, you will receive a $10.00 gift certificate to a coffee shop, a restaurant or for an I-Tunes or Amazon.com gift card.

Participation in this study is voluntary and you may refuse to participate.

If you choose to participate in the study, you may discontinue participation at any time without penalty, benefit or effect on the evaluation in this course or on your employment status.

This study has been reviewed and approved by the OSU Office for Responsible Research Practices (ORRP), Capital University and the OhioHealth Institutional Review Boards.

If you agree to participate, please read and sign the consent form. You will also receive a signed copy of the consent form which includes contact information for myself, the other two investigators for this study and the Office of Responsible Research Practices.

Thank you for considering participation in this study.
Appendix F: Consent Forms
The Ohio State University Consent to Participate in Research

Study Title: The Nature of Presence of Learners Participating in High Fidelity Human Patient Simulation

Researchers: Rick Voithofer PhD & Renee Dunnigan MSN RN

Sponsor: None

This is a consent form for research participation. It contains important information about this study and what to expect if you decide to participate.

Your participation is voluntary.

Please consider the information carefully. Feel free to ask questions before making your decision whether or not to participate. If you decide to participate, you will be asked to sign this form and will receive a copy of the form.

Purpose:

The purpose of this study is to explore the student experience learning with human patient simulation. The aim of the study is to further understand factors that may impact the learner's experience and to support instructional design of human patient simulation scenarios that may improve learning outcomes. This study is not a requirement for the class that you are taking and does not affect your outcome or evaluation in the class in which you are enrolled.

Procedures/ Tasks:

As a normal and required part of class, students will be participating in one or more simulations throughout the quarter/semester. In addition to the normal routine of attending the assigned simulation lab(s) for this class, as a participant in this study, a researcher will observe the simulation lab. Simulations may be video recorded for the researcher to analyze at a later time. You may be asked to complete a group interview during the simulation debriefing or an individual interview after the simulation. If you are asked to complete an individual interview, the researcher will arrange a mutually convenient time and place for the interview. The interview will be about the student experience in the simulation. Ideally, the interview will be completed within 24 hours following your simulation lab. Interviews will be digitally audio recorded.

Duration:

Interviews will take approximately 1-2 hours.

You may leave the study at any time. If you decide to stop participating in the study, there will be no penalty to you, and you will not lose any benefits to which you are otherwise entitled.
entitled. Your decision will not affect your future relationship with The Ohio State University.

Risks and Benefits:

There are no expected risks or discomforts from participating in this study. There may be no direct benefit to you by participating in this study. It is possible that you may benefit from increased self-awareness from participating in an interview. Data from this study may also support advancement in instructional design or learner outcomes related to the use of human patient simulation in future simulation experiences. Data from this study may also change the way future students are educated using human patient simulation. There is also indirect potential benefit to society in that more effective use of simulation may help to increase entry level competency in nurses or physicians and reduce errors in increasing patient safety and quality patient care in the future.

Confidentiality:

You will be asked to provide demographic information such as age, ethnicity and gender in the interview. No personal or uniquely identifying information will be collected in this study. A unique identifier code will be used to link the simulation and the interview. The unique identifier will be created by you or the investigators and will be known only by you and the investigators. Your identity will not be disclosed or reported and any findings from this study will be reported only in aggregated form. No one will know who you are except the investigators who will keep this signed form and all the study data securely in locked filing cabinets or in password protected electronic data storage.

Efforts will be made to keep your study related information confidential. However, there may be circumstances where this information must be released. For example, personal information regarding your participation in this study may be disclosed if required by state law. Also, your records may be reviewed by the following groups (as applicable to the research):

- Office for Human Research Protections or other federal, state, or international regulatory agencies
- The Ohio State University Institutional Review Board or Office of Responsible Research Practices
- The sponsor, if any, or agency (including the Food and Drug Administration for FDA-regulated research) supporting the study.

Incentives:

If you participate in an individual interview, in appreciation of your time and participation in this study, you will receive a $20.00 gift certificate to a coffee shop, a restaurant or for an I-Tunes or Amazon.com gift card.
Participant Rights:

You may refuse to participate in this study without penalty or loss of benefits to which you are otherwise entitled. If you are a student or employee at Ohio State, your decision will not affect your grades or employment status.

If you choose to participate in the study, you may discontinue participation at any time without penalty or loss of benefits. By signing this form, you do not give up any personal legal rights you may have as a participant in this study.

Contacts and Questions:

For questions, concerns, or complaints about the study, you may contact Renee Dunington at 614.425.4365 or Dr. Rick Vaithefer at 614.247.7945.

For questions about your rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact Ms. Sandra Meadows in the Office of Responsible Research Practices at 1-800-678-6251.

If you are harmed as a result of participating in this study or for questions about a study-related harm, you may contact Renee Dunington at 614.425.4365 or Dr. Rick Vaithefer at 614.247.7945.
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CONSENT
Behavioral/Social Science

I have read (or someone has read to me) this form and I am aware that I am being asked to participate in a research study. I have had the opportunity to ask questions and have had them answered to my satisfaction. I voluntarily agree to participate in this study.

I am not giving up any legal rights by signing this form. I will be given a copy of this form.

First name of subject

Signature of subject

Date and time

Printed name of person authorized to consent for subject (where applicable)

Signature of person authorized to consent for subject (where applicable)

Relationship to the subject

Date and time

Investigator/Research Staff

I have explained the research to the participant or his/her representative before requesting the signature(s) above. There are no blanks in this document. A copy of this form has been given to the participant or his/her representative.

Printed name of person obtaining consent

Signature of person obtaining consent

Date and time

Page 4 of 4
Form date: 12/12/00
Title of Study: The Nature of Presence of Learners Participating in High Fidelity Human Patient Simulations

PRINCIPAL INVESTIGATOR: RENE M. DUNNINGTON MSN RN

We are conducting a study to explore the learner experience with human patient simulation. This consent form serves two purposes. First, it provides information on the procedures and risks involved in research so that you can decide if you want to take part in the study.

Second, this form will ask for your permission to use and release information that we will get from you during this study. Please take your time to make your decision about taking part. You may discuss your decision with your friends and family. If you have any questions, you can ask the study researchers for more explanation.

This study is being sponsored by: N/A

You are being asked to take part in this study because you are participating in a human patient simulation learning activity.

WHY IS THIS STUDY BEING DONE?

The purpose of this study is to explore and describe the learner’s experience with human patient simulation. The aim of the study is to further understand variables that may impact the learner’s experience and to support instructional design of human patient simulation scenarios that may improve learning outcomes. This study is not a requirement of the simulation learning activity and does not affect the outcome or your evaluation as a participant in this learning activity.
WHAT IS INVESTIGATIONAL ABOUT THIS STUDY?

You will be participating in the standard simulation activity that has been assigned for your learning. The investigator will observe your simulation lab. Your simulation lab will be digitally video recorded as a normal process with the lab. The investigator will also analyze the video recording of the lab. A group interview will be conducted during the simulation debriefing time. You may also be asked to complete an individual interview at a convenient time for you after the simulation activity. The interview will investigate your experience with the simulation.

HOW MANY PEOPLE WILL TAKE PART IN THIS STUDY?

About 150 people will take part in this study locally through Riverside Hospital CME+I, Capital University and the Ohio State University.

WHAT WILL HAPPEN IN THE STUDY?

As a normal and required part of your learning, you will be participating in simulation learning activities. In addition to your normal routine of participating in the assigned simulation lab(s), as a participant in this study, your simulation lab will be observed by the investigator. As a normal part of the simulation lab, the lab will be video recorded. The investigator will analyze the video recording after the lab. You may participate in a group interview during the debriefing time of the simulation. You may also be asked to be interviewed at a time convenient for you. The interview will be audio recorded. This interview questions will be about your experience during the simulation lab.

HOW LONG WILL I BE IN THE STUDY?

You will be in the study for the duration of the simulation lab learning activities required in your course or program and until the conclusion of the interview that follows the lab experience. The individual interview will take 1-2 hours.

You can stop being a part of this study at any time. However, if you decide to stop being in the study, please notify the researcher.
WHAT ARE THE RISKS OF THE STUDY?
There are no expected risks or discomforts from participating in this study.

ARE THERE BENEFITS TO TAKING PART IN THE STUDY?
If you agree to take part in this study, there may or may not be direct benefit to you. It is possible that you may benefit from increased self awareness from completing the surveys. Data from this study may also support advancement in instructional design or learner outcomes related to the use of human simulation in future simulation experiences. Data from this study may also change the way future learners are educated using human patient simulation. There is also indirect potential benefit to society in that more effective use of simulation may help to increase entry level competency in nurses, physicians or other health care providers, reduce errors and increase patient safety in the future.

What Other Options Are There?
You may choose not to participate in this study without penalty or loss of benefits to which you are otherwise entitled. If you are a student or employee at this institution, your decision will not affect your grades or employment status.

If you choose to participate in the study, you may discontinue participation at any time without penalty or loss of benefits. By signing this form, you do not give up any personal legal rights you may have as a participant in this study.

WHAT ARE THE COSTS?
There are no anticipated costs to you related to participation in this study.

COMPENSATION?
You will receive no payment for taking part in this study. Participants that completed an individual interview for the study will receive a $10 gift card in appreciation for their time and participation in the interview for the study.
WHAT INFORMATION WILL BE COLLECTED FROM ME FOR USE IN THE STUDY?

You will also be asked demographic information such as age, ethnicity and gender for the study. During the interview you will be asked about your experience during the simulation. No personal or uniquely identifying information will be collected in this study. A unique identifier code will be used to link the simulation lab with your observation and interview data. The unique identifier will be created by you or the investigators and will be known only by you and the investigators. Your identity will not be disclosed or reported and any findings from this study will be reported only in aggregated form. No one will know who you are except the investigators who will keep this signed form and all the study data securely in locked filing cabinets or in password protected electronic data storage.

WHAT ABOUT CONFIDENTIALITY?

Efforts will be made to keep your study-related information confidential. However, there may be circumstances where this information must be released. Therefore, if you sign this form and take part in this study, the study staff will be authorized to use the information described above to carry out the purposes of the research study. The study staff will also be authorized to disclose the information described above to all of the following parties involved in the research study:

Organizations that may inspect and/or copy your research records for quality assurance and data analysis include groups such as:

- OhioHealth Institutional Review Board # 1 (Dublin/Grady/Riverside)
- Capital University Institutional Review Board
- Ohio State University Institutional Review Board
- The Department of Health and Human Services Office of Human Subject Research Protections

We cannot guarantee absolute confidentiality. Your personal information may be disclosed if required by law. Once your information is disclosed to the study sponsors, the IRB or the government agencies described above, there is a potential that your information will be re-disclosed and will no longer be protected by federal privacy regulations.
Your study number and initials will be used rather than your name as an identifier on your study records, any photocopies of those records and or device downloads.

If we publish the information we learn from this study in a professional journal, you will not be identified by name or in any other way.

**DO I HAVE THE RIGHT TO DECLINE AUTHORIZATION?**

You have the right to decline to sign this authorization to use/disclose your study information. If you decline, you will not be able to take part in this research study. Except as described herein, if you decline to sign this authorization, your rights concerning treatment, payment for services, enrollment in a health plan or eligibility for benefits will not be affected.

**HOW LONG WILL MY AUTHORIZATION REMAIN IN EFFECT?**

The authorization for use and disclosure of your information will remain in effect for 7 years.

**CAN I WITHDRAW MY AUTHORIZATION?**

You may withdraw your authorization at any time by sending a written request to the Principal Investigator at:

Renee M. Dunnington  
1 College and Main  
Columbus, Ohio 43209

If you withdraw your authorization:

- Your participation in the study will end
- The study staff will stop collecting your information
- The study staff will stop using your information collected in the study.

Your information that has already been used and disclosed prior to withdrawing your authorization remains a part of the research study data.
While the research study is in progress, your access to your study records will be temporarily suspended. Afterwards, you have the right to see and copy the information collected from you in the course of the study, for as long as that information is maintained by the study staff and other entities subject to federal privacy regulations.

**What Are My Rights as a Participant?**

The investigators have answered your questions. You can ask the investigators questions at any time.

Taking part in this study is voluntary. You may choose not to take part or you may leave the study at any time. Leaving the study will not result in any penalty or loss of benefits to which you are entitled.

We will tell you about important new information that may affect your health, welfare and willingness to stay in this study.

**WHOM DO I CALL IF I HAVE QUESTIONS OR PROBLEMS?**

For questions about the study or a research-related injury, contact the study investigator:

**Renee M Dunnington at 614.425.4365**

For questions about your rights as a research participant, contact Dr. James Lewis, Chairman of the OhioHealth Institutional Review Board # 1 which is a group of people who review the research to protect your rights at (614) 566-5319 for Dr. Lewis or Customer Service at (614) 566-5708.

**STATEMENT OF CONSENT AND AUTHORIZATION**

I hereby freely and voluntarily consent to take part in the research study described above. This consent is given based on the verbal and written information provided and the understanding that I am medically and physically qualified to take part in this study. I am free to ask questions at any time.

I have the option to decline to take part or to withdraw from the study at any time without incurring any penalty or loss of benefits otherwise available, including medical care at this institution.

Date

Page 6 of 7

Participant’s Initials _____

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My signature below indicates that I voluntarily agree to take part in this study and that I authorize the use and disclosure of my information in connection with the study. I will receive a signed copy of this consent and authorization form.

________________________________________________________

Patient Signature* Date / Time

________________________________________________________

Research Coordinator/Person Obtaining Consent Date / Time

________________________________________________________

Investigator Signature Date

*If this consent is signed by a legal representative of the patient, check applicable box below explaining your authority to sign for the patient. For legal representatives acting in the capacity as a parent/guardian to the patient, attach a copy of documentation giving you the authority to sign this consent form on behalf of the patient.

- Next of Kin
- Parent (patient is a minor)
- Guardian
- Health Care Power of Attorney
- Health Care Proxy or Surrogate

________________________________________________________

Signature of Patient’s Legally Authorized Representative Date / Time

IF THE PATIENT IS PARTICIPATING BUT UNABLE TO GIVE CONSENT, INDICATE WHY.

________________________________________________________

Witness to consent process (if applicable) Date Time

Date Participant’s Initials _____ Page 7 of 7

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Appendix G: Copyright Permission Letters
October 25, 2011

Renee M. Dunnington
Assistant Professor
Capital University
School of Natural Science, Nursing & Health
1 College & Main
Columbus, OH 43216
RDUNNINGTON@CAPITAL.EDU

Dear Ms. Dunnington:

I am writing in response to your e-mail of October 1, 2011, in which you request permission to publish an image from an NLN publication in a doctoral dissertation for submission to Ohio State University. I am pleased to grant you the following permission:

The The Nursing Education Simulation Framework contained within the book noted below may be used in a doctoral dissertation for submission to Ohio State University:


In granting permission to include The Nursing Education Simulation Framework noted above, it is understood that the following assumptions operate and "caveats" will be respected:

- The requested material will be included only in a doctoral dissertation through Ohio State University.
- The requested material will not be modified in any way.
- The requested material will be cited as noted above.
- The dissertation in which the requested material appears will acknowledge that it has been included with the permission of the National League for Nursing, New York, NY.
- No fees are being charged for this copyright permission.
- The National League for Nursing owns these rights being granted.

I am pleased that material published by the NLN is seen as valuable, and I am pleased that we are able to grant permission for its use. Please call me (612-812-4029) with any questions about items noted in this letter. Thank you.

Most sincerely,

Linda S. Christensen, JD, MSN, RN
Chief Administration Officer
National League for Nursing
lchristensen@nlfn.org

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Hi Renee,

My apologies for taking so long to reply.  
(You were right about the part of me being overwhelmed!)

Yes, by all means you may use the Virtuality Continuum figure; feel free to do so.  
(And thank you very much for asking.)

Best of luck with your dissertation.

Paul Milgram
December 2, 2011

To Whom It May Concern:

This letter is to acknowledge that Renee Dunnington has my permission to print and refer to a simulation scenario that I authored regarding a post-op mastectomy patient. Renee’s work with the scenario relates to her dissertation, but she also has permission to print and refer to the scenario in any future publications that result from her doctoral work.

Sincerely,

Carolyn R. Schubert, DNP, RN-BC
Clinical Assistant Professor
The Ohio State University College of Nursing
1585 Neil Avenue
Columbus, Ohio 43210
614 292 4490
December 20, 2011

Renee M. Dunnington
Assistant Professor
7439 Pepper Hill Ct.
Blacklick, OH 43004

Dear Ms. Dunnington,

The letter hereby grants you, Renee M. Dunnington, permission to use the CAE Healthcare METI Simulated Clinical Experience SOE titled Cardiogenic Shock Secondary to Acute Myocardial Infarction in your dissertation and in future publications generated from your dissertation work. We request that CAE Healthcare METI be given full attribution whenever this SOE is cited, by noting that the SOE is copyright property of CAE Healthcare METI and permission granted for use by CAE Healthcare METI.

Good luck with your academic endeavors.

Regards,

[Signature]

Wendy Jo Wilkinson, MSN, ARNP
Director of Nursing and Allied Health Services
CAE Healthcare
December 7, 2011

Paula Harvey MSN-ED, RN-BC
Program Manager, Simulation & Continuing Nursing Education
The Ohio State University Medical Center
Department of Nursing & Patient Education
660 Ackerman Road
Columbus, OH 43210
(614) 292-2479

To Whom It May Concern:

I give permission for the “Gateway to Critical Care” and “Med/Surg ACTS” simulation scenarios to be reproduced in the dissertation of Renée Dunnington with attribution to myself as the primary author. I also give permission for the scenarios to be presented or published at future conferences or publications that are a result of this dissertation. The scenarios may also be reproduced in original or in abbreviated/adapted form.

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