11-2020

Hospital-Based Nurse Educators' Technology Readiness and Use of High-Fidelity Simulation

Kristen Bryan Wessel
University of Nebraska-Lincoln, krswess@gmail.com

HOSPITAL-BASED NURSE EDUCATORS' TECHNOLOGY READINESS AND USE OF HIGH-FIDELITY SIMULATION

by

Kristen Bryan Wessel

A DISSERTATION

Presented to the Faculty of

The Graduate College at the University of Nebraska

In Partial Fulfillment of Requirements

For the Degree of Doctor of Philosophy

Major: Educational Studies

(Instructional Technology)

Under the Supervision of Justin Olmanson

Lincoln, Nebraska

November, 2020

HOSPITAL-BASED NURSE EDUCATORS' TECHNOLOGY READINESS AND USE OF HIGH-FIDELITY SIMULATION

Kristen Bryan Wessel, Ph.D.

University of Nebraska, 2020

Adviser: Justin Olmanson

This study used a cross-sectional survey design in an aim to compare the technology readiness (TR) of hospital-based nurse educators (HBNEs) that use high-fidelity simulation (HFS) and those that do not use HFS in order to determine if a difference in TR might account for the lack of widespread adoption of HFS in the hospital setting. An online survey was administered to HBNEs from two national organizations: ANPD and SSH. Descriptive statistics and quantitative data analyses were conducted and reported as well as qualitative findings. Descriptive statistics revealed the average age of HBNE to be 45-46 years of age, possessing a master's degree, and less than five years of experience as a nurse educator. Quantitative data analysis used for hypothesis testing did not reveal any statistical significance in TR between HBNE groups, however, additional qualitative inqury did reveal interesting insights with regard to desire to implement HFS, barriers to HFS adoption and use, and support for HFS adoption. This study adds to the limited body of knowledge regarding HFS adoption and use in the hospital-setting. Recommendations for future study include inquiry into barriers to HFS adoption and use in the hospital setting; TR of hospital administrators and perceptions of value are also recommended.

Dedication

It's difficult to express to someone how meaningful it is to have their support.

To my husband, Gale, children, Logan and Lindsey, "Thanks" just isn't enough. Your love and support have carried me through this journey. I love you!

To my amazing family and friends, your encouraging words along the way have been so appreciated.

To my dear colleagues and friends, Mike, Keisha, & Erin, who spent hours reading my proposals and dissertation chapters, provided me with feedback, and asked the tough questions, thank you!

To my committee, Drs. Olmanson, Steckelberg, Golick, & Johnson, who have been so encouraging and supportive throughout this challenging year, sincerest thanks. You have pushed me to be a better researcher and educator.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1: INTRODUCTION

High-fidelity simulation (HFS) is an emerging technology with many reported benefits, making it a recommended strategy for healthcare education and professional continuing education. The emergence of educational technologies over recent decades has brought about numerous opportunities for nurse educators to move from traditional lecture to innovative teaching/learning strategies which include HFS. In higher education, nursing faculty have adopted HFS with an aim to bridge the gap between theory and practice. The goal has been to move students from novice toward expert-level critical thinking and behavioral response (Benner, 2001; Galloway, 2009). Evidence of benefits such as improved self-efficacy and critical thinking that result from HFS (Bambini, Washburn, & Perkins, 2009) are widely reported, thus lending to standards set forth by the International Nursing Association for Clinical Simulation and Learning (INACSL) and recommendations for use by the National Council of State Boards of Nursing (NCSBN) (Hayden, Smiley, Alexander, Kardong-Edgren & Jeffries, 2014). The adoption and integration of HFS has migrated from academic to post-academic education and training of the healthcare team. Based on the review of published research studies and quality improvement projects conveying, hospital-based adoption of HFS appears to be more limited. Lack of wide-spread adoption of HFS in the hospital setting may be, in part, related to the level of technology readiness (TR) of the hospital-based educator who must make the decision to use, or not, specific educational strategies. This hypothesis is supported by findings from the academic setting whereby factors limiting academic faculty adoption of HFS have been reported to include a difference in optimism and innovation (Petersen, 2008), two of the dimensions of TR as identified by Parasuraman and Colby (2001).

TR is a propensity to embrace and use new technologies (Parasuraman & Colby, 2001, 2015; Rockbridge Associates, 2014). It is much more than a simple like (or dislike) of technology which then equates to use (or lack of). TR is a “mindset, not a measure of competency … proven to be a stable characteristic that does not change easily for an individual” (Rockbridge Associates, 2014, para 2). Specific to continuing professional nursing education/training in the hospital setting, the proclivity of a hospital-based nurse educator (HBNE) to embrace HFS as a teaching/learning strategy is highly dependent on overall TR and the levels of each dimension: optimism (belief in positive benefits), innovativeness (desire to explore and experiment), discomfort (perceived lack of control), and insecurity (concern for adverse outcomes) (Parasuraman & Colby, 2001, 2015; Rockbridge Associates, 2014). Thus, if the HBNE does not have a general inclination toward adoption and use of technology, he/she will not be likely to adopt and implement HFS as an educational strategy for continuing professional nursing education in the hospital setting, despite the evidence supporting its use.

The aim of this study is to identify the differences in TR among HBNEs that have adopted and implemented HFS as compared to those that have not in order to determine if TR is a predictor of HFS use. If so, this study will provide greater insight into the differing dimensions of TR so that targeted strategies to support the development of TR among HBNEs that have not adopted HFS can be promoted. The desired result is a population of HBNEs that are open to adoption of HFS; willing and able to implement HFS in order to expand the continuing education/training of professional nurses and other healthcare professionals at a level that meets the demands of a dynamic and increasingly complex healthcare environment.

This chapter will provide an overview of the problem relevant to limited adoption and use of HFS and the indications lending to the hypothesis of TR as a factor. Further, the significance of this study will be discussed, and the research questions and methods will be introduced.

Problem

The problem is multifaceted. The healthcare environment is ever changing in complexity and demands that healthcare professionals continue to learn and hone critical thinking and technical skills in order to ensure the provision of high quality, safe healthcare. HFS is promoted as a strategy that affords many benefits and low risk, thus is a recommended teaching/learning strategy. However, adoption of HFS in the post-academic/hospital-based setting is yet limited, bringing into question the TR of HBNEs who select the teaching/learning strategies for implementation.

Healthcare Environment

Demands of the healthcare environment are continually evolving; growing in complexity as technologies and medical advancements emerge to support life and longevity beyond limitations of the past. The resulting increase in acuity of patients in the hospital setting continues and places a great demand on the healthcare team to extend knowledge and skills beyond that acquired in the academic setting (Hughes, 2008).

HBNEs are charged with the formidable duty to educate nurses and other members of the healthcare team for the duration of time in the workforce. They are responsible for identifying learning needs, developing instruction plans, and implementing education to ensure nursing professionals and members of the healthcare team are armed with the knowledge and skills necessary to provide high quality, safe care. In this endeavor, HBNEs must also implement continuing education aimed to mitigate or prevent adverse outcomes associated with emergent conditions such as cardiac arrest and childbirth complicated by shoulder dystocia as well as preventable medical errors.

According to experts from Johns Hopkins, preventable medical errors are the third leading cause of death in the United States (Makary & Daniel, 2016). Medical errors are defined as follows:

> An unintended act (either of omission or commission) or one that does not achieve its intended outcome,3 the failure of a planned action to be completed as intended (an error of execution), the use of a wrong plan to achieve an aim (an error of planning),4 or a deviation from the process of care that may or may not cause harm to the patient.5 (Makary & Daniel, 2016, p.1)

Human factors, lack of teamwork, and medication errors account for most medical errors (Risser, Rice, Salisbury, Simon, Jay, & Berns, 1999). Thus, HBNEs must plan and implement educational strategies aimed at prevention of medical errors. The HBNE must take into account common causative factors, such as team communication and shortcomings in care planning, and design an educational strategy (or set of strategies) to support improvement in these areas that will result in fewer preventable errors.

HFS as a Strategy

High-fidelity simulation is an innovative education and training strategy that is increasingly utilized in academic healthcare education and is emerging in the post-academic healthcare setting. Simulation is recommended by the Institute of Medicine (IOM) as a strategy to reduce/prevent errors (Kohn, Corrigan, & Donaldson, 2000). One such argument for simulation-based education/training is in response to a needed reduction in medical errors associated with a breakdown within the interdisciplinary team (Hughes, 2008).

> Teamwork training has the capacity to significantly reduce medical errors and therefore improve patient outcome. One common framework for teamwork training is crisis resource management, adapted from aviation and usually trained in simulation settings. (Freytag, Stroben, Hautz, Eisenmann, & Kämmer, 2017, para 1)

One key benefit of HFS is the ability to present opportunities for "hands on" education/training in a real-world situation and environment, though without any safety risk to the patient (Galloway, 2009). The learner(s) can practice, hone assessment and clinical decision-making skills in the safety of a controlled environment (Galloway, 2009; Hughes, 2008; Jeffries, 2005). Evidence from the academic setting suggests benefits of simulation to include improved self-communication, confidence, and clinical judgement (Bambini, Washburn, & Perkins, 2009). There is also emerging evidence to support the integration of HFS in the hospital setting with an aim to increase quality and safety (Hughes, 2008), though greater utilization of HFS by HBNEs may further contribute to the reduction of medical errors and improved patient outcomes.

Limited Adoption

According to the IOM, "health care organizations and teaching institutions should participate in the development and use of simulation for training novice practitioners, problem solving, and crisis management, especially when new and potentially hazardous procedures and equipment are introduced" (Kohn, Corrigan, & Donaldson, 2000, p. 179). Galloway promotes that "educators versed in simulation techniques have laid the foundation for a curriculum framework that removes a considerable amount of the angst and mystery" (2009, para 34), however actual adoption and implementation in the hospital-setting remains seemingly limited. Academic research indicates educator TR is a potential factor limiting adoption of HFS (Petersen, 2008; Caison et al., 2008).

Rogers (2003) suggests that innovation is a social process and theorized five categories of adopters. A continuum whereby innovators are likely to lead the charge, the first to embrace change out of an innate interest. Early adopters and early majority soon follow respectively while the late majority and laggards are somewhat resistant. The latter categories of adopters may be influenced to move toward adoption, but on a varied timeline and under varying degrees of intentional extrinsic influence (Rogers, 2003). Incidentally, Parasuraman and Colby (2001) identify five technology readiness indicator categories that parallel Rogers' categories of adoption: 1) explorer, 2) pioneer, 3) skeptic, 4) paranoid, and 5) laggards. Similar, all individuals can move toward adoption through supportive strategies and influence.

According to Parasuraman (2000), there are four dimensions of TR that impact technology adoption. Two contributing dimensions are optimism and innovativeness. Optimism referring to a belief in positive benefits, and innovativeness defined a desire to learn and experiment with the technology. Two inhibiting factors are discomfort and insecurity. Discomfort noted to be a sense of lack of control, and insecurity, a concern for an adverse outcome (Parasuraman & Colby, 2001). These four dimensions can be used to assess and understand the TR of HBNEs. Given the technological nature of HFS, it is important to assess and understand the readiness of HBNEs relevant to technology adoption and use in order to anticipate potential barriers that may limit HFS integration in hospital-based education/training of healthcare professionals.

Research Questions

The overarching research question used to guide this study is, what is the difference in technology readiness (TR) among hospital-based nurse educators (HBNEs) using high-fidelity simulation (HFS) and those not using HFS? The sub questions follow:

1. Do HBNEs using HFS display a higher level of overall TR as compared to HBNEs that do not use HFS?
2. Do HBNEs using HFS display a higher level of technology optimism as compared to HBNEs that do not use HFS?
3. Do HBNEs using HFS display a higher level of technology innovativeness as compared to HBNEs that do not use HFS?
4. Do HBNEs using HFS display a lower level of technology discomfort as compared to HBNEs that do not use HFS?
5. Do HBNEs using HFS display a lower level of technology insecurity as compared to HBNEs that do not use HFS?

Significance

Insight into these questions may help to identify areas to aim strategies and support in order to build greater TR among HBNEs who have not yet adopted HFS; strategies from the body of evidence are discussed in chapter two The promotion of TR among HBNEs and resulting adoption and implementation of HFS in hospital-based training and continuing professional education has the potential to significantly impact quality and safety of healthcare delivery and positively impact patient outcomes.

Overview of Methods

Chapter three will detail the methods of this research study which will use a cross-sectional survey design to collect data in order to compare TR of HBNEs that use HFS and those that do not. Data collection at a single point in time can be advantageous when measuring attitudes, beliefs, or practices and can be used when comparing two or more groups (Creswell, 2008). In order to compare TR among HBNEs, a convenience sample of HBNEs from the membership of the Association of Nursing Professional Development (ANPD) and the Society for Simulation in Healthcare (SSH) will be obtained, aided by researcher access to the HBNE population through these national professional organizations.

Nurse educator experience and the real-world view of the researcher, in addition to available evidence and expert recommendations, have influenced the purpose and decisions in this study:

- The HBNE population was selected for focus because of the recognized gap existing in the research specific to HFS implementation in the hospital-setting. Further, the barriers to implementation have not been studied among this population and setting to the extent they have been studied in the academic nurse educator population and setting.

- Research aims specific to TR inquiry were selected because of the contribution to the limited body of knowledge specific to hospital-based barriers to implementation of HFS. Findings would inform future research and recommendations.
- Sample selection was purposeful with the aim to target national access to HBNEs, thus two major organizations with membership spanning the nation were selected.
- A working definition of HFS was utilized for this study, supported by academic research and widely accepted INACSL simulation dictionary definitions.
- Assumptions, such as the general tech knowledge of the HBNE, were based on experience and corroborated via the literature and designated competencies of the HBNE, lending to the rationale for survey-based data collection.

The survey will incorporate the 16-item TRI 2.0 instrument, with permission of Rockbridge Associates, which measures TR. Data generated will consist of an overall TR score as well as a breakdown score for each of the four dimensions of TR which are optimism, innovativeness, discomfort, and insecurity. Demographic data will be analyzed and reported using descriptive statistics. Quantitative data analysis of overall TR scores and scores within each of the four dimensions using t-tests to identify and report differences among HBNEs that use HFS and those that do not.

Definitions

Technology readiness as defined by Parasuraman and Colby (2001, 2015) refers to one's propensity to embrace and adopt a technology. Further, the four dimensions of TR are defined as follows:

Motivators

- Optimism – a general belief that technology and innovation has positive benefits
- Innovativeness – an inherent tendency to want to experiment with, learn about and talk about technology

Inhibitors

- Discomfort – a perceived lack of control over technology
- Insecurity – a belief that technology can result in adverse impacts on the user and society (Rockbridge Associates, 2014, para 2)

INACSL provides a standard definition for HFS in the Healthcare Simulation Dictionary:

> In healthcare simulation, high-fidelity refers to simulation experiences that are extremely realistic and provide a high level of interactivity and realism for the learner (INACSL, 2013); Can apply to any mode or method of simulation; for example: human, manikin, task trainer, or virtual reality. (Lopreiato et al., 2016, p. 13)

For the purpose of this study, the definition of HFS will be limited to a simulated patient care experience during which the hospital staff experience a high level of interactivity and realism using a high-fidelity manikin simulator.

The HBNE is a nurse educator in the hospital setting, responsible for training and continued education of healthcare professionals in the post-academic setting. Some may hold positions with a title like [Clinical] Education Specialist, Nurse Educator, or Clinical Educator.

Assumptions, Limitations, & Delimitations

Each research study must be planned and implemented with consideration and awareness of assumptions, limitations, and delimitations. Experience and real-world view of the researcher in addition to available evidence and expert recommendations have influenced assumptions as well as decisions throughout the study.

Assumptions

Bryant purports assumptions as "the beliefs we bring to the study that we will accept as valid" (2004, p. 56). One such assumption of this study is that HBNEs will reply honestly in response to the survey. Respondents will be assured that confidentiality will be preserved through strict data security measures in order to increase likelihood that respondents will answer honestly. Further, the nursing profession has been recognized as the #1 most ethical and trusted profession for the 18th year in a row, according to a 2019 Gallup poll (Reinhart, 2020).

Another assumption is that the HBNE will accurately self-identify as a user or a non-user of HFS. To aid in self-identity of HFS users vs. non-users, the definition of HFS as used in the study will be provided in the survey. Further, participants will be given reassurance of anonymity with an aim to solicit accurate self-reporting as a user or a non-user of HFS.

Arguably, HFS as a preferred/recommended strategy may be considered an assumption. Numerous gains have been realized by the researcher as well as colleagues within the researcher's professional network as a result of first-hand experience with HFS. The literature review in chapter two will provide substantial evidence to corroborate the gains of HFS and further support the implementation of HFS. Further, the literature review will validate the researcher's experience-based claim that widespread post-academic use of HFS presents as a gap in the literature necessitating inquiry.

Limitations

According to Creswell (2008), "limitations are potential weaknesses or problems with the study identified by the researcher" (p. 207) and may involve sampling, response rate or retention of participants, measurement errors and/or potential errors of data collection and analysis. A potential limitation of this study is relevant to sampling. It is difficult to identify and access HBNEs specifically that utilize HFS and those that do not. For this reason, the Society for Simulation in Healthcare (SSH) was identified as one nationally recognized organization in which HBNEs using simulation may be prominent, given the nature of the organization is specific to simulation in healthcare. In the converse, it was more difficult to identify an access point to HBNEs that do not utilize HFS, however the Association of Nursing Professional Development (ANPD) was selected because of the nationally recognized presence and membership specific to nursing professional development (i.e. HBNEs).

Convenience sampling may also be recognized as a limitation. In comparison to randomized selection, convenience samples are scrutinized for a lack of generalization to the population as a whole (Creswell, 2008). In an attempt to minimize bias and improve generalizability, sampling from two national organizations was implemented with an aim to improve representation from a diverse geographic area as well as hospital size/type. The two professional organizations will be implemented because of ease of access to the HBNE population of interest across the United States, and thus lending to representation of the population at large; not limited to a single geographical area which may be influenced by common resources, values, and/or access.

Surveys also present with some limitations in that the respondent is unable to seek clarification regarding the survey questions and/or how to complete the survey (Simon & Goes, 2013). Additionally, the electronic survey requires that the participants have access to email and the internet and the knowledge to use these technologies. Given that today's healthcare industry widely utilizes electronic medical records, etc., it is assumed that the HBNE population has the necessary knowledge and skills for basic email and internet use. Based on the experience of the researcher, it is not only assumed that HBNEs will have access to technologies such as email and the internet, but in most organizations are expected to use both readily. This assumption is further validated by the Technology Informatics Guiding Educational Reform (TIGER) competencies published in 2009 (TICC) guiding standards requiring basic technology knowledge and skills for all nurses.

Delimitations

Delimitations are viewed as the boundaries of the study, factors included as well as excluded from the study, determined by the researcher (Simon & Goes, 2013). The purpose of this study is to explore TR as a factor in HFS use by HBNEs. Other factors potentially impacting use of HFS by HBNEs such as administrator support and motivation were not considered in this study. Future study relevant to these variables is, however, recommended.

The population of interest is limited to only nurse educators in the hospital setting. Other healthcare educators, non-nurse educators such as allied health or medical educators, are not included as an expansive population is problematic given the difference in education and professional focus; nurses are knowledgeable about nursing while other healthcare professionals are familiar with their respective field. Additionally, nurse educators working in a clinic, free-standing surgical center, home health or long-term care centers were not included as a significant variation in the setting for continuing education and professional development may be present with respect to education and training needs. The hospital setting presents some similarities in that hospitals have similar high-stakes education/training needs such as to prevent failure to rescue (AHRQ, 2019) and improve code response; situations where training with HFS can have a profound impact on patient outcomes.

Conclusion

This chapter has provided an overview of the proposed study. The problem, identified as the lack of wide-spread adoption of HFS among HBNEs, despite a wealth of evidentiary support for implementation of HFS in order to meet the demands of the complex healthcare environment, and TR as a factor impacting adoption were presented. Chapter two will detail a review of the literature whereby evidence from both the academic and post-academic settings is discussed.

CHAPTER 2: LITERATURE REVIEW

This chapter will provide an overview of HFS; contextual use & benefits/gains supporting recommendations for HFS adoption in hospital-based continuing education/training. Faculty perceptions & barriers to HFS use in hospital-based education will be identified. TR as a factor impacting technology/HFS adoption and implications for the development of TR will be discussed. Lastly, this chapter will present the evidence with respect to suggested strategies to promote TR and/or dimensions of TR.

Simulation

Simulation technology has been widely utilized in the military and aviation industries for many decades; in healthcare, low fidelity simulation has long been utilized, however the integration of HFS in healthcare has been more recent. Gaba describes 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” (2007, para 1). In the simulation environment, the learners are subject to real-world, high-risk situations where they can hone assessment and decision-making skills as well as technical skills in an environment where the patient is not subject to harm (Jeffries, 2005; Hughes, 2008; Galloway, 2009; Hayden et al., 2014). Simulation is “an evidence-based strategy to facilitate high-quality experiences that foster thinking and clinical reasoning skills for students” (NLN, 2015).

There are different types of simulation that can be implemented as teaching-learning strategies, often classified by the level of fidelity. The Healthcare Simulation Dictionary identifies elements of fidelity to include

> (a) physical factors such as environment, equipment, and related tolls; (b) psychological factors such as emotions, beliefs, and self-awareness of participants; (c) social factors such as participant and instructor motivation and goals; (d) culture of the group; and (e) degree of openness and trust, as well as participants' modes of thinking (INACSL, 2013)" (Lopreiato, et al., 2016, p. 11).

Often healthcare simulations are classified as high-fidelity or low-fidelity and classification is based on the level of realism provided with respect to each of these elements (Lopreiato, et al., 2016), while some experts further delineate a mid-range of fidelity given the many variables in this definition. In general, the level of fidelity integrated in the simulation is planned based on the objectives of the simulation and thus considerations made for physical, conceptual, and psychological elements lending to desired level of realism (INACSL Standards Committee, 2016).

Low-fidelity simulation modalities have long been utilized in nursing education for the purpose of task training, such as the use of an IV arm for pre-licensure nursing students to practice the tactile skill of intravenous insertion or a torso training manikin that is used to practice the skills necessary for cardio-pulmonary resuscitation. Through task training, skill development and procedural confidence can be acquired, however the task-based simulation provides no patient feedback and is not perceived by the learner as feeling real. Low-fidelity simulation does not require a manikin or physical interaction (Lopreiato et al., 2016). Virtual simulation, i.e. computer-based tasks, are also considered low-fidelity as the level of realism remains low (Lopreiato, et al., 2016).

High-fidelity simulations (HFS) integrate a variety of elements that lend to a sense of realism. Manikin-based simulators, operated by a trained simulationist, interact with the learner and provide feedback (Lopreiato et al., 2016). A mock shoulder dystocia *in situ* simulation provides an example of HFS. *In situ* refers to a simulation held in a real-world practice setting (Lopreiato et al., 2016), such as that of a Labor and Delivery suite. In the simulation, the patient (a high-fidelity human patient simulator) may be calling out in pain, the spouse anxious and asking lots of questions, the fetal heart rate monitor alarming with a dangerous drop in fetal heart rate while the healthcare team members work in tandem to manage the emergency. Changes in the maternal-fetal status occur as the team works, providing real-world feedback as to the success or failure of the team's efforts. The use of a mannequin-based simulator is common with HFS, but also standardized patients (SPs) may be used to add fidelity to simulation. SPs are actors who may be used as the patient, or others such as family members, to interact with the healthcare staff and provide feedback during the simulation (Lopreiato et al., 2016).

Adoption and integration of HFS is supported by many experts. The National League for Nursing (NLN) and the NCSBN support the use of HFS in academic education as a replacement for traditional clinical; up to 50% based on the findings of the NCSBN study (Hayden, Smiley, Alexander, Kardong-Edgren & Jeffries, 2014' NLN, 2015). Gaba purports the necessity of full integration of simulation in the healthcare system; academic education and training as well as continued lifelong learning of the entire healthcare team in order to ensure high quality and safe patient care (Gaba, 2007). The IOM supports the adoption and use of HFS in training and continuing education in the healthcare setting for the purpose of error prevention as well as to bridge the knowledge gap between novice and expert clinicians (Kohn, Corrigan, & Donaldson, 2000). HFS implementation in both the academic and continuing professional education is demonstrated in the research, though to varying degrees.

Academic vs. Professional Setting Implementation

In the academic setting, faculty have integrated and expanded the use of HFS with an aim to provide healthcare students with constructivist learning opportunities that would promote critical thinking and translation of knowledge to practice. Integration of simulation in healthcare education has arguably become the norm in nursing education with widespread use across many academic institutions (Aebersold, 2018). Numerous supporting studies from the academic realm have shown outcomes of HFS as an instructional strategy to include acquisition of high-level skills and knowledge (Laschinger et al., 2008; Cooper, Kinsman, Buykx, McConnell-Henry, Endacott, & Scholes, 2010; Steadman et al., 2006; Cook et al., 2011), development of clinical judgement (Dillard, Sideras, Ryan, Carlton, Lasater, & Siktberg, 2009) and improvement in critical thinking (Seybert & Kane-Gill, 2011), as well as critical assessment and management skills (Steadman et al., 2006), and high level of learner satisfaction (Laschinger et al., 2008; Seybert & Kane-Gill, 2011). As a result, Aebersold (2018) reports simulation use in academic nursing education has expanded to the extent that many states boards of nursing have adopted the National Council of State Boards of Nursing (NCSBN) guidelines for use of simulation as a replacement for some academic clinical experience requirements with support for implementation of the 2016 INACSL Standards for Best Practice. And "to do it [simulation] well, faculty need to learn to effectively design, facilitate, and debrief simulation-based experiences to meet objectives for learning experiences" (Aebersold, 2018, para. 44) which has brought about numerous training and certification programs.

Less research-based evidence can be found with regard to the inquiry into post-academic simulation adoption and use, specifically from the hospital setting. Harper (2018) published a study of simulation use in U.S. hospitals which was a collaborative effort of three national organizations: Association for Nursing Professional Development (ANPD), International Nursing Association for Clinical Simulation and Learning (INACSL), and Society for Simulation in Healthcare (SSH). The aim of the study was to address a gap in the literature with regard to the extent of simulation use in the acute care setting and focused inquiry in the areas of "purpose and aims of simulation, the simulation site, simulation participants, content of simulation activities, simulation modalities, and the logistics and operations of the simulation center" (Harper, 2018, p. 243). Though findings indicated an increasing use of simulation in healthcare, the response rate was low (3%) and the study was not clear to identify if representation of an organization by multiple participants was taken into account (Harper, 2018). Use of a variety of simulation modalities were identified (HFS, medium to low fidelity, task trainers, standardized patients, computer-based simulation, and hybrid simulation) and barriers to simulation use were outlined: cost, lack of designated personnel, space, supplies, equipment, leadership, staff too busy, and no simulation champion (Harper, 2018). However, three fourths of the study participants were simulation users, and the study did not include an inquiry into non-simulation participant desire, ability, and/or propensity/TR for simulation adoption and use. Preparation of simulation users was addressed, only minimally, noting that few simulation users are certified (Harper, 2018).

HFS implementation in the professional setting is purported as a means to bridge the gap between novice and expert clinician (Thomas & Kellgren, 2007; Traynor et al., 2010). As such, some hospital-based nurse internships and nurse residency programs have implemented simulation in the curriculum to transition new nurses into professional practice (Rossler, Hardin, Hernandez-Leveille, & Wright, 2018). Researchers note participant perceptions were generally positive with regard to gained comfort in communication, collaboration, relationships, role identity, psychomotor skills, and critical thinking (Rossler et al., 2018). However, the narrow base of literature related to HFS in the post-academic healthcare setting has been limited to quality improvement projects and single-site studies. A significant focus of both academic and post-academic research has been to identify outcomes of learning and learner gains.

Benefits & Gains

Numerous gains have been associated with the implementation of HFS as a teaching-learning strategy. Of significance are gains associated with interprofessional teamwork and communication as well as knowledge, skill, performance, confidence, and self-efficacy.

Self-Efficacy/Confidence, Knowledge & Skill Acquisition

Cooper, Kinsman, Buykx, McConnell-Henry, Endacott, and Scholes (2010) studied a simulation-based intervention aimed at early recognition and effective management of the deteriorating patient with undergraduate nursing students and concluded that nursing students in their final year were inadequately prepared to identify and manage the deteriorating patient. However, other simulation studies found that HFS was a valuable tool for developing students' self-efficacy (Dunn, Osborne, & Link, 2014).

The evidence indicates significant interest in acquired self-efficacy/ self-confidence and clinical competence. Banks, Stanley, Brown and Matthew (2019) implemented an interprofessional education (IPE) simulation with nursing and social work students and found increased confidence and competence among participants in addition to an improved understanding of the other profession. Blum, Borglund, and Parcells (2010) studied entry-level nursing students enrolled in either a traditional or a simulation-enhanced clinical rotation in order to determine the relationship between self-confidence and clinical competence as measured by the Lasater Clinical Judgment Rubric throughout the semester. Findings indicated an improvement in self-confidence and competence of students in both groups over the course of the semester, though no significant difference was identified between the groups (Blum et al., 2010).

Dunn, Osborne, and Link (2014) studied the impact of HFS on self-efficacy relevant to communication and physical patient care as measured by the Nursing Student Self-Efficacy Scale (NSSES) and found an improvement in students' self-efficacy. Likewise, Traynor, Gallagher, Martin, and Smyth (2010) performed a study to examine confidence and proficiency resulting from HFS experienced by third-year nursing students in Northern Ireland. Students reported improved understanding and confidence (Traynor et al., 2010). Further, students reported that the simulation experiences helped to bring to light gaps in personal knowledge while also helping them to acquire a better understanding of the relationship between theory and practice (Traynor et al., 2010).

In a study of senior level academic nursing students, Duprey and Silver Dunker (2019) found an increase in confidence and knowledge resulting from participation in a megacode simulation. The majority (95%) identified satisfaction as well as perceived knowledge, skill acquisition, and translation to the clinical setting (Duprey, 2019). Habibli, Ghezeljeh, and Haghani (2020) similarly studied retention of knowledge and skill performance resulting from simulation-based cardiopulmonary resuscitation education. They found gains with respect to knowledge and performance as well as greater retention over three months when compared to the control group not exposed to simulation-based education (Habibli et al., 2019). Similarly, Barra and Singh Hernandez (2019) reported increased confidence, awareness, proficiency, and passing exam scores as evidence to support HFS as a replacement for clinical while Soccio (2017) promoted simulation as a replacement for 25% of traditional clinical based on an equivalent measure of knowledge and confidence gains in simulation as compared to only traditional clinical. Tamaki, Inumaru, Yokio, Fujii, Tomita, Inoue, et al. (2019) also found improved knowledge, skill performance, and self-confidence resulting from simulation-based learning experience of third-year Japanese nursing students.

Kapucu (2017) conducted interviews of third-year nursing students following a high-fidelity simulated chest trauma scenario with an aim to understand nursing students' opinions of simulation education. The researcher concluded that students found the training useful with regard to skill improvement, and the realism contributed to a sense of confidence that the improved skills could be applied beyond the simulation (Kapucu, 2017).

Leighton (2007) used survey design to assess nursing students' perceptions of learning outcomes met as a result of simulation in comparison to other environments. Results indicated that the perception of achieved learning needs (self-efficacy, holism, communication, and nursing process) was higher in the traditional clinical environment as compared to the simulation environment. Further, "Learning needs of the Teaching Learning Dyad and Critical Thinking subscales were met adequately in both" simulation and traditional clinical environment (Leighton, 2007). Likewise, a study of Tennessee State Board of Nursing (SBON) pass rates was conducted by Brown (2013). The study compared SBON pass rates from the five years preceding HFS adoption to the five years after HFS adoption among 37 pre-licensure nursing programs. The researcher concluded that there was no significant improvement in meeting learning outcomes as a result of HFS adoption (Brown, 2013).

Kim, Issenberg, and Roh (2020) studied the effects of a simulation-based Korean Advanced Life Support (KALS) education strategy and found gains in nursing student knowledge, performance, and self-efficacy. Gains of the simulation intervention group were significant over the control group which received only lecture-based education (Kim et al., 2020). The researchers recommend curricular implementation of simulation based KALS education based on the positive effects identified by the study (Kim et al., 2020). Lee, Kang, Park, and Kim (2017) reported similar findings when studying senior nursing students learning to care for children with croup. Three groups were compared: one group received only a simulation-based learning experience, one group only a classroom lecture (referred to as "pre-education), and one group who received both the classroom instruction and a simulation-based learning experience (Lee et al., 2017).

Researchers concluded that the group of nursing students subjected to both the classroom and simulation had significant gains with regard to knowledge, confidence in performance, and satisfaction as compared to the other two groups (Lee et al., 2017).

Cook et al. (2011) corroborated findings of knowledge and skill acquisition via a systematic synthesis of data from 609 studies. In a study conducted by Grady, Kehrer, Trusty, Entin, Entin, and Brunye (2008), researchers sought to identify the difference in skill acquisition resulting from HFS in comparison to low-fidelity simulation among first year nursing students. Findings revealed that students participating in HFS demonstrated improved performance (Grady et al., 2008).

Partin, Payne, and Slemmons (2011) studied second-year associate of science in nursing students' perceptions of learning following a series of HFSs. Students shared reflections of the experience and researchers determined that enhanced learning and a general sense of preparedness for nursing practice were emerging themes (Partin et al., 2011). Guhde (2011) examined nursing student's perceptions of learning in comparison of simple versus complex HFSs and found student learning to be similar, supporting the idea that HFS, regardless of complexity, can be an effective learning activity.

Lucas (2008) promotes the implementation of HFS in the hospital setting with an aim to improve competency and confidence. Gordon and Buckley (2009) studied the gains associated with HFS in graduate nurses. Outcomes of the study included improved confidence as well as skill enhancement resulting from participation in an advanced resuscitation simulation (Gordon & Buckley, 2009).

Fero et al. (2010) studied simulation use in the academic setting and found that students perceived an increase in knowledge that could be transferred to real world practice. A qualitative study conducted by Botma (2014) reported similar findings whereby students perceived application of theoretical knowledge could be applied in real world practice and felt critical thinking was improved.

Delac, Blazier, Daniel, and N-Wilfong (2013) implemented a "Five Alive" HFS program in a hospital with the aim to improve code response and patient outcomes. As a result of HFS training, response times improved significantly along with confidence of the nurses (Delac et al., 2013). Boet et al. (2011) also found that clinical skills improved and were retained for at least a year as a result of HFS. Thus, simulation was recommended for training of healthcare professionals in the hospital setting. Garcia-Jorda et al. (2019) noted improved compression skill with real-time feedback (measured via appropriate rate, depth, and recoil) initially, though compression rate decreased when reassessed three to six months and more than six months after the intervention. Crowe, Ewart, and Derman (2018) examined outcomes associated with HFS education for nurses on a general medical unit in Canada and found significant improvements in confidence and knowledge; sustained gains over a period of three months.

In situ simulations involve HFS in the patient care setting and include healthcare professionals at varied stages of their professional careers; fully credentialed and practicing, in a multidisciplinary interaction (Lopreiato et al., 2016; Rosen et al., 2012; Patterson, Geis, Falcone, LeMaster & Wears, 2013). *In situ* simulations in the hospital setting have been shown to lend to gains such as increased confidence with regard to ability to recognize and initiate interventions for the deteriorating patient (Lee, Mowry, Maycock, Colaianne-Wolfer, Knight, & Wyse, 2019). Evidence of improved clinical confidence as a result of *in situ* simulation has been corroborated by other research studies (Shrestha, Shrestha, Shrestha, Basnet, & Pradhan, 2019; van Schaik et al., 2011; Dowson, Russ, Sevdalis, Cooper & De Munter, 2013; Wehbe-Janek, Pliego, Sheather, & Villamaria, 2014). Further, researchers report additional gains associated with *in situ* simulation to include knowledge retention (Bultas, Hassler, Ercole, & Rea, 2014; Boet et al., 2011), performance improvement (Bultas et al., 2014; Lipman, Carvalho, Cohen, Druzin & Daniels, 2013; Wehbe-Janek et al., 2014), and improved teamwork (Bultas et al., 2014; Holcomb et al., 2014; Patterson et al., 2013; van Schaik, Plant, Diane, Tsang, & O'Sullivan, 2011) as a result of HFS use. Further, quality improvement studies noted improved patient outcomes (Andreatta, Saxton, Thompson, & Annich, 2011 Braddock, Szaflarski, Forsey, Abel, Hernandez-Boussard, & Morton, 2015; Knight, Gabhart, Earnest, Leong, Anglemeyer, & Franzon, 2014; Sodhi, Singla, & Shrivastava, 2015; Riley et al., 2016; Theilen, Fraser, Jones, Leonard, & Simpson, 2017) as a result of simulation use for staff education. However, Steinemann et al. (2011) and Riley et al. (2011) did not report a significant impact in patient outcomes as a result of *in situ* simulations.

Interprofessional Teamwork & Communication

Numerous researchers have examined the benefits of interdisciplinary simulation in healthcare education. Dillon, Noble, and Kaplan (2009) examined outcomes associated with collaborative simulation implemented among fourth-year nursing students and third year medical students. Both nursing and medical students' perceptions of collaboration resulting from the simulation experience were identified as positive gains in the findings (Dillon et al., 2009). Similarly, Baker et al. (2008) encountered a positive response to interprofessional simulation activities and determined that responses from nursing students, medical students, and junior medical residents as measured by the Interdisciplinary Education Perception scale were also positive.

Teamwork and effective communication among members of the healthcare team is an important element of high quality, safe healthcare (Ghaferi & Dimick, 2016). Cain, Riess, Gettrust, and Novalija (2014) sought to study outcomes of an interdisciplinary education (IPE) simulation to improve early recognition and management of malignant hyperthermia, a rare, yet life-threatening event. Findings of the study included role clarity and team cohesion (Cain et al., 2014). Related, Strachan, Graham, Hormis, and Hilton (2011) concluded that teamwork, confidence and medical management of emergencies improved as a result of simulation-based training. Similarly, Banks et al. (2019) noted perceptions of an improved understanding of others' role/discipline following IPE simulation in the academic setting.

Murray, Judge, Morris, and Opsahl (2019) reported on an IPE simulation aimed at disaster response with nursing and paramedic/emergency medical technician (EMT) students. Faculty surveys revealed perceived gains with effective communication among the healthcare team, though communication remained an ongoing challenge (Murray et al., 2019). Student surveys revealed student perception of achievement across all learning objectives, including collaboration and care coordination which was the highest ranked objective perceived by students (Murray et al., 2019).

Russell, Brown, Manella, Colquitt, and Ingram (2020) conducted an IPE simulation with respiratory therapy and nursing students in their final year of the respective programs, specifically to assess attitudes of students participating in an IPE seminar on TeamSTEPPS. TeamSTEPPS is an evidence-based curriculum for healthcare professionals with an aim to teach skills in leadership, situational monitoring, mutual support, communication, and team performance (AHRQ, 2019). The data were collected via survey pre-seminar, post-seminar, and, for the intervention group, post simulation. Findings of the study indicated improvement in the students' attitudes improved across all domains following the seminar and was sustained across all domains except mutual support for the intervention group following the simulation (Russel et al., 2020). Fawaz and Anshasi (2019) also found similar outcomes in that students held positive attitudes toward simulation-based IPE, felt knowledge was improved, and interpersonal skills honed.

Faculty Perceptions

Studies of educator perceptions of technology use have emerged from the academic setting. Blake (2009) studied the attitudes of healthcare faculty in an academic setting and found that the majority of educators had positive attitudes towards instructional technology integration, however, some retained reservations and/or lacked experience, knowledge, and confidence of the technologies, thus limiting implementation. Despite a lack of confidence, faculty conveyed a general willingness to acquire knowledge of e-learning methods (Blake, 2009). Other barriers to technology implementation included lack of time to prepare materials, lack of support and guidance, lack of electronic course content, and insufficient equipment (Blake, 2009). Though limitations and barriers to implementation exist, faculty felt e-learning integrations would enhance classroom teaching, tutor-student communication, student-student communication, and learning as well as would be important for online assessment and simulation exercises (Blake, 2009).

Ashrafzadeh and Sayadian (2015) also identified self-concern as a limitation to implementation of technology. Their study of faculty perceptions of technology integration revealed self-concern was top among barriers such as lack of administrative facilities, instructors' technology literacy, and accessibility (Ashrafzadeh & Sayadian, 2015). Similarly, Dowie and Phillips (2011) reported that faculty lacked confidence and preparation to implement simulation. Savery (2002) found that faculty identified themselves as competent with basic technologies such as email, internet and library research, however, self-rating of competency and analysis of comments with respect to competency with other technologies reinforced the need for faculty training.

Technology Readiness

Technology readiness, the "propensity to embrace and use new technology for accomplishing goals in home life and at work" (Parasuraman, 2000, p. 308), has been studied in a variety of populations. For example, understanding the consumers' propensity to use technology can be helpful to those in marketing who are working to get the word out about consumer products (Parasuraman & Colby, 2001). Likewise, an understanding of technology readiness and associated factors may be useful in other industries, such as the healthcare industry, as new technologies continue to emerge.

Specific to the healthcare industry, Caison et al. (2008) studied the technology readiness of medical and nursing students in Canada, given the need to work with electronic health records (EHRs). Aside from comparison of TR between nursing and medical students, other variables of interest included geographical location (rural vs. urban), gender, and age differences (Caison et al., 2008). Findings suggested greater insecurity with technology in rural nursing students versus urban nursing students, greater innovation in male medical students over female medical students though female medical students demonstrate a higher overall TR, and a negative TR score of medical students over the age of 25 (Caison et al., 2008). As a result, researchers recommended curricular changes that would foster TR to aid in EHR adoption and use (Caison et al., 2008).

Duvall (2012) conducted a national survey of nurse educators to assess factors such as TR and motivation relevant to use of HFS using the Revised Motivation at work Survey (R-MAWS) and the TRI instruments. Findings suggested a high level of TR among nurse educators in the academic setting, however, overall TR did not appear to be a significant factor relevant to use of HFS (Duvall, 2012). Likewise, Janse van Vuuren, Seekoe, and Goon (2018) reported findings from a national survey in South Africa assessing perceptions of academic nurse educators and concluded that overall TR was probably not a significant factor in the use of HFS, though the national sample was quite small, and other factors such as training/preparation for simulation may be of greater significance.

Kuo, Liu, and Ma (2013) studied TR as it related to nurses' adoption of mobile electronic medical record (EMR) systems and found all four dimensions as identified by Parasuraman & Colby (2001) to have a significant impact on perceived ease of use. However, only optimism was significant as it relates to perceived usefulness of the mobile EMR technology (2013). Odlum (2016) also studied TR of nursing students and reported general readiness for technology among the study participants, however insecurity scores were higher and aligned with findings of Kuo et al. (2013).

Zayim and Ozel (2015) reported findings of an inquiry into nursing students' perceptions of readiness for mobile learning technologies, identifying perceived ease of use, personal innovativeness, and self-management of learning as significant factors for intention to use mobile technologies for learning. Other reported factors for readiness included perceived usefulness, perceived device limitation, and availability (Zayim & Ozel, 2015).

Petersen (2008) conducted a survey of academic nurse educators with the TRI instrument developed by Parasuraman and Colby (2001) and sought to identify factors associated with utilization of clinical simulation. Noted differences in TR dimensions of optimism and innovation were found between nursing faculty utilizing clinical simulation as compared to those not implementing clinical simulation along with a negative correlation between age and innovation (Petersen, 2008) suggesting TR as a factor impacting adoption of HFS. Petersen (2008) suggested that academic administrators consider TR factors as well as strategies to promote acceptance of new technologies in order to elevate use of clinical simulation in nursing education.

Diffusion of Innovation Theory

Rogers' Diffusion of Innovation Theory, originally published in 1962, explains the process by which an innovation diffuses through a population to the point of widespread adoption (2003). In his theory, Rogers (2003) identified five categories of adoption: innovators, early adopters, early majority, late majority, and laggards; innovators being the first to try and adopt the new idea; laggards being those that are the most skeptical and thus the most difficult group to change.

Similarly, Parasuraman and Colby (2001) identified five technology readiness classifications based on TR scores: explorers, pioneers, skeptics, paranoids, and laggards. According to research using the TRI, one can identify those "who are enthusiastic about adoption but must be given help and reassurance to ensure an innovation moves along the adoption curve" (Rockbridge Associates, 2014, para. 8). For example, explorers possess a high level of optimism and innovativeness though are low in discomfort and insecurity while pioneers are high in all 4 dimensions; thus, differing strategies may aid in technology adoption among individuals and populations according to classification (Rockbridge Associates, 2014).

Strategies to Develop TR and Promote Adoption

Parasuraman defined innovativeness as "a tendency to be a technological pioneer and thought leader" while optimism is defined as "a positive view of technology and a belief that it offers people increased control, flexibility, and efficiency" (2000, p. 311). Of the four dimensions, Demirci et al. (2008) found innovativeness held the most significance of all four TR dimensions, followed by optimism, when it came to a propensity to adopt new technology. Mental enablers and inhibitors of TR determine a predisposition toward new technologies (Lin, Shih, & Sher, 2007). Because it is possible for optimistic and innovative people to also experience some anxiety (Parasuraman, 2000), even those high in optimism and innovation may benefit from reassurance and reinforcement.

Starkweather and Kardong-Edgren (2008) promoted a process by which to support diffusion of HFS innovation that began with identification of an innovation champion. The role of the champion was to first garner faculty interest and motivation. Next, the innovation champion helped to open discussion with reluctant faculty with an aim to convert to interested and engaged faculty, ready for the formal course and 2-day retreat. Last, the faculty were supported through guided development and implementation. This process moved faculty through the five stages of diffusion: knowledge, persuasion, discussion, implementation, and confirmation. (Starkweather & Kardong-Edgren, 2008)

Identified as barriers to faculty development and use of FHS are "lack of faculty buy-in, faculty confidence, fear of technology, lack of knowledge, and uncertainty of skill level" (Atkinson, 2008; Hanburg, 2008; Jansen et al., 2009; Jansen et al., 2010; King et al., 2008; Miller & Bull, 2013; Nehring & Lashley, 2004 as cited by Nehring et al., 2013, p. 25). Barriers such as lack of confidence and uncertainty hinder innovation and optimism. Researchers promote the need for faculty champions (Starkweather & Kardong-Edgren, 2008; Anderson et al., 2012; Atkinson, 2008; Davis, 2012; Fountain, 2011; Howard et al., 2011; Jones & Hegge, 2007 as cited by Nehring, Wexler, Hughes, & Greenwell, 2013, p.25), planned faculty development in the form of workshops and train-the trainer sessions (Starkweather & Kardong-Edgren, 2008; Anderson et al., 2012; Jansen et al., 2010; Jones et al., 2012; King et al., 2008) in order to promote TR and adoption of HFS use and implementation. Hollema (2015) support a need for formal faculty education specific to simulation as a result of finding that educators had significant apprehension with respect to personal ability. Further, Kuo et al. (2013) recommended continuing education programs aimed to enhance technology literacy and to minimize discomfort.

Discussion

The research promotes a wealth of benefits that stem from integration of HFS in education and training of healthcare professionals. Given the high-stakes nature of healthcare relevant to the demand for high quality, safe care, HFS is a viable instructional technology that offers a risk-free learning environment in which to hone effective knowledge, skills, and behaviors. However, the selection and implementation of technologies is dependent on the educator. The attitudes and beliefs of educators may have an impact on the implementation of technologies such as HFS, or lack of, in both the academic and post-academic settings. For this reason, the study of TR as a potential predictor is important to the body of knowledge relevant to increased integration of HFS in a post-academic setting such as with hospital-based staff education.

The evidence suggests many benefits can be associated with HFS but does not explain why HFS is not more widely adopted in the hospital setting. Is it because HBNEs are limited with respect to TR? If so, what can be done to positively influence TR and the adoption of HFS? This study seeks to identify if differences in TR exist between HBNEs that use HFS and HBNEs that do not. Further, an understanding of the differences among the two groups of HBNEs may lend to the identification of strategies that will support greater TR and adoption of HFS, such as mentorship programs, formal education, and designated simulation champions. The literature to this regard is limited to quality improvement projects and single-site studies, with only a few exceptions.

CHAPTER 3: METHODS

The study used a cross-sectional survey design to compare TR of HBNEs that use HFS versus those that do not. “Survey studies describe trends in the data rather than offer rigorous explanations … [the] focus is directed more toward learning about a population” (Creswell, 2008, p. 388). Survey research design was selected because of the desire to learn about the attitudes and beliefs of the HBNE population relevant to HFS as opposed to experimental research involving the administration of a treatment. The cross-sectional survey design affords the researcher the ability to capture a snapshot of the beliefs, practices, and attitudes of two groups within a population at a single point in time (Creswell, 2008). This chapter will address the methods used in this study including sample size and procedures, data collection procedures, instrumentation, and statistical testing for data analysis.

Sampling

The population of interest for this study was specific to nurses specializing in the post-academic continuing education and professional development of the nursing staff and other members of the healthcare team in the hospital setting. This specific population of nurse educators is somewhat different from the nurse educators in the academic setting in that the aim of academic education is to build foundational knowledge, skills, and behaviors in preparation for professional practice, however continued learning and professional development is an expectation and necessity. Further, translation of knowledge and skill to clinical application in care of the patient is paramount to quality healthcare and positive patient outcomes.

> Until now, greater emphasis has been placed on pre-practice education, which generally ranges from 5 to 15 years, yet the practice life of a health care professional can range from 35 to 40 years. (ACICBL, 2011, p. 12)

In the hospital setting, the education team has the profound responsibility to continue the development of knowledge, skills, best practices, and critical thinking beyond the foundational knowledge and skills learned in the academic setting in order to provide high-quality care to patients in the healthcare environment.

> The complexity of the current healthcare system requires increasing specialization of nurses. Nurses who are initially well prepared and continue to develop professionally throughout their career are a key factor in obtaining positive patient outcomes. (ANPD PCC, 2013, p.3)

Given the important role of HBNEs, a deeper understanding of this population is needed. HBNEs are drivers for adoption of educational technologies such as HFS as well as limiting factors, in order to best support progressive, cutting-edge and effective continuing education of healthcare professionals with an aim to meet the unique and dynamic needs of the patients who receive healthcare in the hospital.

Though continuing education/professional development of professional nurses and members of the healthcare team may vary in significance from that of academic education, there are similarities as well. Savery (2002) found that academic faculty reported email, chalkboard, overhead projector, and video technologies as the instructional technologies with a high frequency of use. Correspondingly, the HBNEs of interest are assumed to have some general familiarity with basic technologies such as email which is commonly utilized among staff in healthcare organizations.

Access to a representative sample of HBNEs was achieved through two professional organizations. Participants were solicited from the Association of Nursing Professional Development (ANPD) and the Society for Simulation in Healthcare (SSH). ANPD is a national association dedicated to the advancement of nursing professional development. Membership is exclusive to nurses specializing in professional development (i.e.: professional nurse educators) in a variety of roles and healthcare settings. Participants were limited to Registered Nurses employed as nurse educators in the hospital setting. SSH is a national organization promoting simulation in healthcare education with a goal to promote high quality patient care and positive patient outcomes. The organization supports simulation innovation and promotes the *Healthcare Simulationist Code of Ethics* which has been adopted by numerous professional organizations. Membership is open to all healthcare professionals, inclusive of professional nurses, but not exclusive to only nurses. Participants from this organization were limited to nurse educators in the hospital setting; eliminating invitation to other organizational members who were not Registered Nurses and/or not functioning as a nurse educator in the hospital setting. Sampling from these two sources provided access to a diverse mix of HBNEs across the United States, representative of the target population and of both groups; HBNEs that use HFS and those that do not.

Convenience sampling was utilized for this study. “Convenience sampling is a type of nonprobability sampling in which people are sampled simply because they are "convenient" sources of data for researchers” (Lavrakas, 2008, para 1). A captive population of HBNEs, though not restricted by limitations of a single organization or physical/geographical proximity, HBNEs from ANPD and SSH were selected because of the ability to obtain representation of HBNEs from a wide array of hospitals across the United States. This included representation from urban, suburban, and rural hospitals; large and small healthcare systems; for profit and non-profit facilities; and public and private entities.

A limitation of this study may be found in the potential for hidden bias as a result of convenience sampling "because of the high self-selection possibility in non-probability sampling, the effect of outliers can be more devastating in this kind of subject selection" (Etikan, Musa, & Alkassim, 2016, para 7). This was taken into consideration in the study design as participants were solicited from two professional organizations with membership spanning the entire United States with the aim to diversify the sample. Unfortunately, the researcher was limited by access to the population given the national geographical distance and number of hospitals and restricted access to direct contact information, thus making it necessary to seek out organizations frequented by the population of interest in order to gain access to representatives of the population of HBNEs. The selected professional organizations, inclusive of HBNE members spanning the United States, arguably lends to the best representation of HBNEs from a diverse mix of hospital size and locale as well as affords the researcher access to a sampling pool large enough to obtain the desired number of participants. Thus chosen for this study in order to overcome limitations of access to directory information which would allow for systematic, random selection, or other sampling method, convenience sampling was feasible as well as time and cost effective (Lavrakas, 2008).

A power analysis for an independent sample, two-tailed *t*-test was conducted in G-POWER using a moderate effect size (d=.5), alpha (α=.05) and power of .8 to determine a desired sample size of 128; equally divided among HBNEs using HFS and HBNEs that do not utilize HFS. “The power of a statistical test of a null hypothesis is the probability that it will lead to the rejection of the null hypothesis, i.e., the probability that it will result in the conclusion that the phenomenon exists” (Cohen, 1988, p.4). An alpha of .05 was utilized as a common error value given the aim to reject the null hypothesis in a two-tailed t-test of independent measures. These values were supported via prior research and the resulting desired sample size was thus justified as practical.

Survey Design

The survey was designed to address inquiry into the participant qualifications, demographics of the participants, interest or interaction with HFS, and the TRI 2.0 study instrument.

Qualifying Questions

Initial survey questions were designed to ensure only qualified participants self-selected for the study. Two questions were asked to ensure the participant was a Registered Nurse and employed in an educator role in the hospital setting.

Demographic Items

Construction of the demographic inquiry was based on general inquiry as well as guided by previous studies. “background questions (or demographic questions) assess the personal characteristics of individuals” in the sample (Creswell, 2005, p. 362). Inquiry included age, gender, highest academic degree, years of experience as a Registered Nurse, years of experience specializing in nursing education. Further inquiry into the demographics of the hospital included state, rural or urban area, and type of hospital (academic or non-academic; for-profit or not-for-profit).

HFS Interest/Interaction

This study primarily focused on quantitative data collection and analysis specific to TR, however additional survey items were included in the survey with an aim to further understand the perspective of the HBNE relevant to HFS adoption and use (Creswell, 2005). Included in the additional inquiry were closed-ended, open-ended, and semi-closed-ended survey items. While quantitative inquiry is founded in closed-ended questions for the purpose of measurement, open-ended questions “allow participants to create responses within their cultural and social experiences instead of the researcher’s experiences” (Neuman, 2000 as cited by Creswell, 2005, p. 364). Semi-closed-ended questions carry advantages of both open-ended and closed-ended questions in that the respondent can write in an answer that may not fit with the choices provided, yet there is less qualitative data to be coded by the researcher (Creswell, 2005). Content validity was established via review of two experts in nursing education (Creswell, 2005).

Branching items were created based on the participant’s response to the closed-ended, yes or no question: “Do you utilize high fidelity simulation in your educator practice?” Participants that responded in the negative were further asked, “Would you like to learn how to integrate high fidelity simulation…?” (closed-ended question) followed by “what factors have prevented you from integrating high fidelity simulation?” as a semi-closed-ended question. This was intended to elicit additional insights with regard to the HBNEs interest in HFS adoption and the presence of any extrinsic barriers that may exist.

Participants that self-identified as a HFS user were presented with two additional questions, both open-ended:

"Why have you chosen to integrate high fidelity simulation in the education/training of healthcare professionals in your organization?"

"What education and/or training have you received to support implementation of high fidelity simulation?"

The aim of these questions was to better understand HBNE reasoning and preparation for HFS adoption and implementation.

The survey also ended with a general call for additional comments or thoughts; posed as an open-ended question.

Study Instrument

The 'TRI 2.0' is a 16-item 5-point Likert-based instrument used to assess technology readiness (Parasuraman & Colby, 2015). Selected for this study based on previous use in research studies involving healthcare and education, the Technology Readiness Index (TRI) provides a reliable and valid measure of attitudes and behaviors that correlate with an inclination to adopt technology. The TRI 2.0 instrument is an updated and more efficient version of the original 36-item TRI. (Parasuraman & Colby, 2015)

The original TRI was developed to measure TR relevant to consumers' attitudes and behaviors toward technology use (Parasuraman, 2000). Based on focus group interviews and subsequent research, four dimensions of TR emerged: optimism, innovativeness, discomfort, and insecurity, whereby optimism and innovativeness are drivers of TR, and discomfort and insecurity are inhibitors of TR (Parasuraman, 2000). Parasuraman (2000) conducted additional research and identified the four dimensions to be predictive of interaction with technology. The ability of the TRI scale to discriminate across a variety of relationships with technologies lent to demonstrated construct validity.

TRI 2.0 was the product of a redevelopment of the original TRI brought about by the evolution of technology since the origination of the TRI. Redevelopment involved a collection of qualitative data from participants across the United States via asynchronous online discussion to identify consumer definition of "cutting edge" technology and "obtain information about motivators and inhibitors underlying the adoption and use of cutting edge technologies" (Parasuraman & Colby, 2015, p. 62). Analysis of the discussion reaffirmed emerging themes from the original TRI creation, though also confirmed a new view of "cutting edge" technologies that prompted rewording of instrument items (Parasuraman & Colby, 2015).

In the quantitative phase of the redevelopment, 45 TR statements were randomized and tested via mail survey administered to 2500 U.S. residents; a total of 524 usable responses were received and data analyzed (Parasuraman & Colby, 2015).

> Analysis were conducted to derive a more parsimonious scale by eliminating items from the augmented list of 45 existing and new items. The primary criteria guiding these analyses focused on ensuring sufficient reliability for the four TR dimensions, while simultaneously limiting each dimension to as few items as possible, and preserving the index's dimensional structure. (Parasuraman & Colby, 2015, p. 65)

Reliability and validity are paramount to instrument selection. "Reliability means that scores from an instrument are stable and consistent" while validity "means that the individual's scores from an instrument make sense, are meaningful and enable … the researcher, to draw good conclusions" (Creswell, 2008, p. 169). Parasuraman and Colby (2015) reported that "all dimensions meet the minimum reliability threshold: The lowest reliability (Cronbach's α) is .70 for discomfort and the highest is .83 for innovativeness" (p. 66) as well as goodness of fit (goodness-of-fit index: .95). According to Goforth (2015) at the University of Virginia, an alpha (α) greater than .65 is recommended, indicating a high level of covariance, thus a consistent measure of the concept. Hooper, Coughlan, and Mullen (2008) assert that a goodness-of-fit index greater than .9 indicates a well-fitting model.

Further analysis of the instrument for construct validity revealed significance at the .001 level and "suggest that TR is an important predictor of technology-related behaviors" (Parasuraman & Colby, 2015, p. 68). According to Dahiru, "Values close to 0 indicate that the observed difference is unlikely to be due to chance, whereas a P value close to 1 suggests no difference between the groups other than due to chance" (2008, para 5). Thus, the TRI 2.0 instrument was determined to be a reliable and valid means for measurement of TR and appropriate for implementation with this study population.

Permission for use of the TRI 2.0 instrument was requested and approved license was granted by Drs. Parasuraman and Colby in association with Rockbridge Associates (Appendix C). Instructions with recommendations for administration via survey were taken into consideration as the survey and procedures were developed.

Procedures

Following IRB approval and taking standards and ethical practices for research involving human subject into consideration, members of the ANPD and SSH were contacted via email and the respective organization's discussion boards, including

LinkedIn. HBNEs were invited (Appendix A) to participate in a short internet-based survey, beginning first with an electronic consent and then transitioning the participant to the survey (Appendix B). The survey was constructed and administered via Qualtrics; a proprietary survey platform commonly used by researchers for data collection.

Completed survey data were reviewed for inclusion/exclusion criteria. Responses from non-nurse educators and/or educators from the academic realm were excluded from the study. Total TR scores were then computed based on instructions provided by Parasuraman and Rockbridge Associates. Data were then analyzed and reported.

Data Analysis

Demographic data were analyzed and reported using descriptive statistics. "The purpose of descriptive statistics is to simply and organize a set of scores … summarized by one or two values that describe the entire set" (Gravetter & Wallnau, 2009, p. 762). A description of participants' age, education completed, years as an RN, position title, role/responsibilities as HBNE, years of experience as a HBNE, and self-reported engagement in HFS were reported.

Quantitative Data Analysis

The data collected from the sample of HBNEs via the TRI 2.0 instrument were inclusive of an overall TR score, indicating a general level of propensity for technology adoption. Total TR scores for each study group, HBNEs using HFS and HBNEs not using HFS, were reported using measures of central tendency (mean, mode, & range) as well as variability, "a quantitative measure of the degree to which scores in a distribution are spread out or clustered together" (Gravetter & Wallnau, 2009, p. 105), for comparison. The most used measure, "standard deviation uses the mean of the distribution as a reference point and measures variability by considering the distance between each score and the mean" (Gravetter & Wallnau, 2009, p. 109). Additionally, measures of central tendency and standard deviation for each dimension of TR (optimism, innovativeness, discomfort, and insecurity) by group were calculated and reported in chapter four.

To determine differences in TR between the two groups, as well as differences among groups with respect to each dimension, an independent measures t-test was used in hypothesis testing. The independent measures, or between-subjects research design, involves making a comparison of the mean difference between two groups of individuals in order to determine if a significant difference exists (Gravetter & Wallnau, 2009). Further, effect size using Cohen's *d* were reported. "A measure of effect size is intended to provide a measurement of the absolute magnitude of a treatment effect, independent of the size of the sample(s) being used" (Gravetter & Wallnau, 2009, p. 262).

The research questions were tested based on the following associated hypotheses:

1. Do HBNEs using HFS display a higher level of TR as compared to HBNEs that do not use HFS?

   Null Hypothesis: There will be no difference in TR scores between HBNEs using and those not using HFS.

   H_0: $\mu_{HFS} = \mu_{noHFS}$

   Analysis: independent measures t-test & effect size (two tailed)

2. Do HBNEs using HFS display a higher level of technology optimism as compared to HBNEs that do not use HFS?

   Null Hypothesis: There will be no difference in optimism between HBNEs using and those not using HFS.

$H_0: \mu_{HFS} = \mu_{noHFS}$

Analysis: independent measures t-test & effect size (two tailed)

3. Do HBNEs using HFS display a higher level of technology innovativeness as compared to HBNEs that do not use HFS?

   Null Hypothesis: There will be no difference in innovativeness between HBNEs using and those not using HFS.

   $H_0: \mu_{HFS} = \mu_{noHFS}$

   Analysis: independent measures t-test & effect size (two tailed)

4. Do HBNEs using HFS display a lower level of technology discomfort as compared to HBNEs that do not use HFS?

   Null Hypothesis: There will be no difference in discomfort between HBNEs using and those not using HFS.

   $H_0: \mu_{HFS} = \mu_{noHFS}$

   Analysis: independent measures t-test & effect size (two tailed)

1. Do HBNEs using HFS display a lower level of technology insecurity as compared to HBNEs that do not use HFS?

   Null Hypothesis: There will be no difference in insecurity between HBNEs using and those not using HFS.

   $H_0: \mu_{HFS} = \mu_{noHFS}$

   Analysis: independent measures t-test & effect size (two tailed)

The Statistical Package for the Social Sciences (SPSS) was used to perform statistical calculations.

Finally, scores for the TRI 2.0 assessment, devoid of identifiers and extraneous data, were subjected to a proprietary quantitative analysis by Rockbridge Associates in order to obtain classifications based on Parasuraman and Colby's research (2015). Classifications are reported in chapter four and discussed as compared to U.S. normative data in chapter five.

Additional Data Analysis

The study primarily focused on quantitative data collection and analysis, however additional survey items were included with an aim to further understand the perspective of the HBNE relevant to HFS adoption and use. Frequencies were reported for selected responses and open coding used to analyze free text responses.

Open coding analysis procedures as in grounded theory research were employed for text-based responses based on recommendations by Creswell (2005, 2014) and Merriam (2009) using inductive thematic analysis whereby themes are generated from the raw data as opposed to theory or prior research (Nowell, Norris, White, & Moules, 2017). The responses were reviewed for general ideas and concepts with an aim to consider organization of the data relevant to the process of coding. Then the text-based responses were entered into the ATLAS.ti Cloud software for open coding. Codes were generated during the first review and honed over two additional passes of the data. In the axial coding phase, a code map was created with an aim to view the data for themes/links, seeking approximately five to seven themes (Creswell, 2014). Strauss and Corbin (1998) note the purpose of axial coding is to identify categories based on subcategories with an aim to provide a thorough explanation grounded by the insider knowledge of the researcher. Code maps were used to guide code grouping and chunking; an example is shown in Figures 1 and 2 in chapter four. The code maps, with code frequencies, were helpful to view the data for themes/links. Daily referred to the use of mapping when creating themes or links in the data: “Linking and tagging helps to keep the participant meaning and research context central in the data analysis process” (2004, para 11).

Significance

Findings from this study are anticipated to aid in the promotion of HBNE development with respect to technology integration, specifically to support HFS implementation in hospital-based continuing education/training. A study by Petersen (2008), concluded that there was a significant difference in TR of academic faculty as related to involvement in simulation and recommended to pair average and high scoring that faculty in order to foster simulation innovation. If TR or if one or more dimensions of TR, optimism or innovation, are found to be low and/or if discomfort or insecurity are found to be high and therefore a possible predictor of slow adoption of technologies such as HFS, strategies can be sought in an effort to positively influence HBNE TR and adoption and subsequent use of HFS.

Conclusion

This chapter provided an overview of the methods employed in this study, offering an overview of the population of interest as well as justification for sampling methods. Rationale for the cross-sectional survey design and use of the TRI 2.0 instrument was discussed and the procedure for implementation of the survey provided. Further, the implemented plan for data analysis and reporting was discussed and justified.

Results are reported in chapter four with supporting tables. Chapter five offers a detailed discussion of the findings as they contribute to the body of knowledge and hold implications for HBNEs, Directors of Education, hospital administrators, and simulation trainers/educators. Lastly, recommendations based on the findings and suggests considerations for future research studies are also provided in chapter five.

CHAPTER 4 – RESULTS

The results of the data analysis relevant to each research question are reported in this chapter. Data were analyzed using IBM SPSS Statistics; analysis reporting includes descriptive statistics of the sample population as well as quantitative TR data. Interpretation of the findings, implications, and suggestions for future research are presented in Chapter five.

Descriptive Statistics of the Sample Population

Survey responses were received from 147 individuals, nine were eliminated as respondents noted they were either not a Registered Nurse, not employed in the hospital setting, or not a nurse educator; one was eliminated due to incomplete survey. Thus, 128 responses, equally divided among HBNEs that use simulation and those that do not use simulation, were included in data analysis. Survey data were collected from HBNEs from 36 U.S. states, and two outside the U.S. Of the total 128 respondents, 114 (89.1%) identified as female (Table 1) and 87 (68%) reported holding a master's degree (Table 2).

Table 1.

Respondents by Gender

Gender	HFS User (n=64)	Non-HFS User (n=64)	Total (N=128)
Male	5	8	13 (10.2%)
Female	59	55	114 (89.1%)
Non-response	-	1	1 (.8%)

Table 2.

Educational Preparation of HBNEs

Degree	HFS User (n=64)	Non-HFS User (n=64)	Total (N=128)
Bachelor's Degree	7 (10.9%)	15 (23.4%)	22 (17.2%)
Master's Degree	44 (68.8%)	43 (67.2%)	87 (68.0%)
Doctorate	13 (20.3%)	6 (9.4%)	19 (14.8%)

HBNE respondents ranged from 28 to 68 years of age with the mean age of 46.09 years (Table 3). The mean age for HFS users and non-users was within one year of the population mean; however, the mode age of the HFS user group was 14 years younger.

Table 3.

Age of Respondents

HBNE	N	Mean	Mode	Range
HFS User	64	45.25	36	30-65
Non-HFS User	64	46.94	50	28-36
All Participants	128	46.09	50	28-68

Of respondents, 18% reported 10-14 years of experience working as a Registered Nurse. This level of nursing experience was similarly reflected among non-simulation users as the majority reported 10-14 years (20.3%) of experience. Among simulation users, the majority of HBNE experience was split between the 10-14 year (15.6%) and 20-24 year (15.6%) ranges (Table 4).

As it pertains to years of experience specializing in nursing education, 27.3% of the total HBNE participants reported 1-4 years of experience. The majority of simulation users reported 10-14 years (31.3%) of experience specializing as a nurse educator while non-simulation users reported 1-4 years (29.7%) of experience as a nurse educator (Table 5).

Table 4.

Years of Experience as Registered Nurse

Years	HFS User (n=64)	Non-HFS User (n=64)	Total (N=128)
1-4	-	-	-
5-9	8 (12.5%)	3 (4.7%)	11 (8.6%)
10-14	10 (15.6%)	13 (20.3%)	23 (18%)
15-19	8 (12.5%)	11 (17.2%)	19 (15.8%)
20-24	10 (15.6%)	10 (15.6%)	20 (15.6%)
25-29	9 (14.1%)	7 (10.9%)	16 (12.5%)
30-34	9 (14.1%)	9 (14.1%)	18 (14.1%)
35-39	7 (10.9%)	5 (7.8%)	12 (9.4%)
40+	-	4 (6.3%)	4 (3.1%)
Non-response	3 (4.7%)	2 (3.1%)	5 (3.9%)

Table 5.

Years of Experience as Nurse Educator

Years	HFS User (n=64)	Non-HFS User (n=64)	Total (N=128)
1-4	16 (25%)	19 (29.7%)	35 (27.3%)
5-9	18 (28.1%)	16 (25%)	34 (26.6%)
10-14	20 (31.3%)	12 (18.8%)	32 (25%)
15-19	5 (7.8%)	6 (9.4%)	11 (8.6%)
20-24	1 (1.6%)	6 (9.4%)	7 (5.5%)
25-29	1 (1.6%)	4 (6.3%)	5 (3.9%)
30-34	2 (3.1%)	1 (1.6%)	3 (2.3%)

Geographically, 42 (32.8%) of respondents came from the Midwest, 31 (24.2%) from the Northeast (24.2%), 20 (15.6%) from the Southeast, 17 (13.3%) from the Southwest, 16 (12.5%) from the West region of the US, and two responses were from outside the US (Table 6). Of the 64 simulation users and 64 non-simulation users, the majority of simulation users were from the Northeast (29.7%) while the majority of non-simulation users were from the Midwest 37.5%. Overall, 18.8% identified as working in a rural area hospital, 81.2% urban area hospital (Table 7).

Table 6.

Setting of HBNE Practice

Practice Setting	Simulation User (n=64)	Non-Simulation User (n=64)	Total (N=128)
Rural	10 (15.6%)	14 (21.9%)	24 (18.8%)
Urban	54 (84.4%)	50 (78.1%)	104 (81.2%)

Table 7.

Region of HBNE Practice

US Region	HFS User (n=64)	Non-HFS User (n=64)	Total (N=128)
West	7 (10.9%)	9 (14.1%)	16 (12.5%)
Southwest	9 (14.1%)	8 (12.5%)	17 (13.3%)
Midwest	18 (28.1%)	24 (37.5%)	42 (32.8%)
Southeast	10 (15.6%)	10 (15.6%)	20 (15.6%)
Northeast	19 (29.7%)	12 (18.8%)	31 (24.2%)

Hypothesis Testing

A two-tailed independent measures *t*-test was performed to address each of the research questions for hypothesis testing (Table 8). Reported *t*-test findings, including effect size follow. Using Levene's Test for Equality of Variances, the significance levels were all greater than α .05 indicating an assumption of equal variance among simulation and non-simulation users.

Research Question 1: Do HBNEs using HFS display a higher level of TR as compared to HBNEs that do not use HFS?

The independent *t*-test was conducted to determine if a difference existed between the mean overall TRI scores of simulation users and non-simulation HBNEs. Of the 128 participant responses, no statistically significant difference was found between the mean TRI scores of simulation users (n=64, M= 9.40, SD = 7.69) and non-simulation users (n=64, M = 7.25, SD = 8.53), *t*(126) = 1.47, p=.15. The effect size, Cohen's d .26, was small. The 95% confidence interval was -.73 to 4.95. Findings were counter to the hypothesis; thus the null hypothesis was not rejected.

Further hypothesis testing compared mean differences among the two groups relevant to each of the TR dimensions of optimism, innovativeness, discomfort, and security (Table 8).

Research Question 2: Do HBNEs using HFS display a higher level of technology optimism as compared to HBNEs that do not use HFS?

An independent measures *t*-test was used to determine if a difference in the TR dimension of optimism was noted between HBNEs that use simulation and those that do not. Analysis revealed that there was no statistically significant difference between the mean optimism scores of simulation users (n = 64, M = 16.31, SD = 2.17) and non-simulation users (n = 64, M = 15.70, SD = 2.47), *t*(126) = 1.48, p = .14. The effect size, Cohen's d .26, was small. The 95% confidence interval was -.20 to 1.42 and the null hypothesis was not rejected.

Research Question 3: Do HBNEs using HFS display a higher level of technology innovativeness as compared to HBNEs that do not use HFS?

An independent measures *t*-test was used to determine if a difference in the TR dimension of innovativeness was noted between HBNEs that use simulation and those that do not. Analysis revealed that there was no statistically significant difference between the mean innovativeness scores of simulation users (n = 64, M = 14.86, SD =

3.06) and non-simulation users (n = 64, M = 13.94, SD = 2.99), *t*(126) = 1.72, p = .09. The effect size, Cohen's d .30, was small. The 95% confidence interval was -.14 to 1.98. The null hypothesis was not rejected.

Research Question 4: Do HBNEs using HFS display a lower level of technology discomfort as compared to HBNEs that do not use HFS?

An independent measures *t*-test was used to determine if a difference in the TR dimension of discomfort was noted between HBNEs that use simulation and those that do not. Among the sample of HBNEs, there was no statistically significant difference between the mean discomfort scores of simulation users (n = 64, M = 10.03, SD = 2.93) and non-simulation users (n = 64, M = 10.22, SD = 3.19), *t*(126) = -.35, p = .73. The effect size, Cohen's d .06, was small. The 95% confidence interval was -1.26 to .88. The null hypothesis was not rejected.

Research Question 5: Do HBNEs using HFS display a lower level of technology insecurity as compared to HBNEs that do not use HFS?

An independent measures *t*-test was used to determine if a difference in the TR dimension of insecurity was noted between HBNEs that use simulation and those that do not. Among the sample of HBNEs, there was no statistically significant difference between the mean insecurity scores of simulation users (n = 64, M = 11.78, SD = 2.90) and non-simulation users (n = 64, M = 12.17, SD = 3.10), *t*(126) = .65, p = .46. The effect size, Cohen's d .13, was small. The 95% confidence interval was -1.44 to .66. The null hypothesis was not rejected.

Table 8.

Comparison of HBNE TR Scores

TR Dimension	HFS User	N	Mean	SD	*t* statistic	*p* value*
Optimism	Yes	64	16.31	2.17	1.48	.14
	No	64	15.70	2.47		
Innovativeness	Yes	64	14.86	3.06	1.72	.09
	No	64	13.94	2.99		
Discomfort	Yes	64	10.03	2.93	.35	.73
	No	64	10.22	3.19		
Insecurity	Yes	64	11.78	2.90	.65	.46
	No	64	12.17	3.10		
Total TRI	Yes	64	9.36	7.69	1.47	.15
	No	64	7.25	8.53		

*$p < .05$, two-tailed

In summary, the null hypotheses were not rejected via quantitative hypothesis testing, indicating no significant differences in TR among two groups of HBNEs, those that use HFS and those that do not use HFS. However, an inability to reject the null hypotheses does not indicate a lack of findings or that the null hypotheses must be accepted. “Adequate reporting of nonsignificant findings renders scientific literature as a whole more complete, and allows for a better judgment about the replicability of scientific work” (Mehler, 2019, p. 2). The results of the hypothesis testing indicate that a couple of possibilities exist: 1) there is no difference in TR among the groups or 2) the difference in TR among the groups is so small that it is difficult to distinguish given limitations of the evidence within the sample (Mehler, 2019).

TR Classification of HBNEs

Raw TR scores were analyzed, and classifications applied by Rockbridge Associates, using a proprietary system of review. The classification distribution among the two groups of HBNEs reviewed and reported (Table 9), noting the majority from both groups are “explorers” followed by “skeptics”. The only notable difference between the two groups of HBNEs is that there are no identified "avoiders" among the HBNEs that use simulation. Significance of the classifications is discussed in Chapter five.

Table 9.

Comparison of HBNE TR Classifications by Group

Group	Classification	Frequency	Percent
HFS non-user	Skeptics	25	39.1%
	Explorers	26	40.6%
	Avoiders	3	4.7%
	Pioneers	8	12.5%
	Hesitators	2	3.1%
	Total	64	
HFS user	Skeptics	20	31.3%
	Explorers	32	50%
	Avoiders	0	0%
	Pioneers	7	10.9%
	Hesitators	5	7.8%
	Total	64	

Instrument Reliability Testing

The TRI 2.0 instrument, consisting of 16, 5-point Likert scale items lending to an overall TR assessment score and a further breakdown score for each of the four dimensions of TR (optimism, innovativeness, discomfort and insecurity) was administered in this study. Based on internal consistency testing, the overall TRI scores on this assessment were reliable (Cronbach's $\alpha = .80$) and internal consistency among each of the four dimensions revealed optimism (Cronbach's $\alpha = .70$) and innovativeness (Cronbach's $\alpha = .77$) to be considered reliable based on a Cronbach's $\alpha \geq .70$ as satisfactory reliability relevant to internal consistency; internal consistency of discomfort (Cronbach's $\alpha = .69$) is also considered acceptable for the purpose of this study as there is some support for values >.60 (Taber, 2018). The TR dimension of insecurity (Cronbach's α = .52) fell outside the acceptable range for internal consistency; considered "low" with regard to internal consistency.

Additional Findings

While quantitative methods for data collection were of primary focus in this study, additional survey items were administered with an aim to further the understanding of HBNE experiences relevant to HFS adoption, inclusive of free text responses. The results of the analysis of the additional questions follow.

Non-HFS User Group Desire for HFS

Participants that self-identified as HFS users, were asked if they would like to learn how to integrate high fidelity simulation. Of the 64 HBNEs that identified as non-simulation users, 53 said they would like to learn how to integrate high fidelity simulation; only 11 would not want to integrate HFS. A post hoc analysis using Welch's t-test was used to compare these sub-groups of non-simulation users based on recommendations from the literature for use of Welch's t-test when sample sizes and variance differ among groups (Moser & Stevens, 1992). No statistically significant differences were found among the sub-groups with regard to overall TR, $t(13.05) = -.59$, $p = .56$. (Table 10).

Table 10.

Welch's t-test Comparing Sub-Groups of Non-HFS Users

Dimension of TR	Desire	N	Mean	SD	*df*	*t statistic*	*p value**
Total TRI	Yes	53	6.92	8.29	13.05	-.59	.56
	No	11	8.82	9.93			
Optimism	Yes	53	15.72	2.52	15.25	.10	.92
	No	11	15.64	2.34			
Innovativeness	Yes	53	13.87	2.94	13.38	-.37	.72
	No	11	14.27	3.35			
Discomfort	Yes	53	10.25	3.27	15.70	.16	.88
	No	11	10.10	2.91			
Insecurity	Yes	53	12.42	3.12	15.21	1.45	.17
	No	11	11.00	2.90			

*$p < .05$, two-tailed

Non-HFS User Group Identified Barriers

Further, non-simulation users were asked a semi-closed-ended question to elicit a greater understanding of factors/barriers to simulation adoption and use. They were provided with the following question and options:

What factors have prevented you from integrating high fidelity simulation?

1. Access – "The equipment and/or space is not available to me."
2. Cost – "My organization does not have funds to support high fidelity simulation."
3. Personal knowledge/skill – "I don't have enough information or training."
4. Lack of administrator support – "the organization's administrator(s) don't feel the investment is necessary."
5. Personal value – "I don't see the value in simulation. There are other effective strategies."
6. Other – please specify: (free text entry)

Respondents could select more than one preventative factor/barrier (frequencies are shown in Table 11). Among the participants, HBNEs not using HFS shared that access and cost are key barriers to HFS adoption and implementation.

Table 11.

Factors Preventing HFS

Preventative Factor	Frequency
Access	47
Cost	37
Personal knowledge/skill	19
Lack of administrator support	17
Personal value	0
Other	8

Open coding of the eight free text responses for the “other” option was used to determine if free-text responses could be categorized and thus counted with the provided options. Analysis revealed that additional factors, not accounted for in the options, were identified.

Among the participants, HBNEs not using HFS offered insights with regard to the reasons why. One of the eight participants noting “other” provided, “Available resources (manpower to continuously lead and perfect)” as a barrier.

Four participants indicated simulation isn’t applicable to their role. One shared, “not part of my role to implement new ways of learning,” another stated, “I do not teach in person, only virtual” and two indicated their organizations have simulation, however explained “it doesn’t fit my job responsibilities” and “it is used for department based education and training. My role is as a centralized PDS” indicating there may be organization-based limitations on educator roles.

Two respondents indicated that their organizations are in the process of adopting simulation, one of which shared the organization is building a simulation facility.

> "Our corporate office is currently building a sim center to serve our large metropolitan area, and being aware of their long-term plans has caused most of us to wait for the completion of the new training center."

Two respondents noted a lack of reliability of the simulation equipment as a barrier to implementation. One indicated "when the products work …" and the other participant noted the organization owned the equipment, but HFS was not adopted as a teaching/learning strategy due lack of simulation equipment reliability.

> "We have high fidelity simulators HAL, Victoria, and the pediatric hal. The software, hardware and connections are unstable and have caused serious disruption to the department's credibility because the activities are often delayed or stopped as a result. Victoria is a little less so than HAL."

Similarly, Harper (2018) noted barriers to include cost, lack of designated personnel, and lack of support from leadership, though additional barriers such as staff too busy and no simulation champion were also noted by Harper and not participants in this study. The finding of personal knowledge/skill as a barrier confirms similar findings from the academic setting in the literature (Nehring et al., 2013). Though the literature from the academic setting also conveys barriers to include educator buy-in and fear (Nehring et al., 2013), buy-in and fear were not validated barriers in this study as no respondents selected personal value as a preventative factor and no free-text responses could be linked to fear.

HFS Adoption Group Rationale for Adoption

Self-identified HFS users were asked the open-ended question, "why have you chosen to integrate high fidelity simulation in the education/training of healthcare professionals in your organization?" Free-text responses were received from 93.75% of HBNE users and entered into ATLAS.ti for open coding. Initial open coding elicited 30 codes, reduced to 26 on third pass with elimination of duplicate codes. Axial coding brought about four emerging themes resulting in categories explaining reasons for HFS adoption: learning environment, learning gains, types of use, and support for HFS (Figure 1).

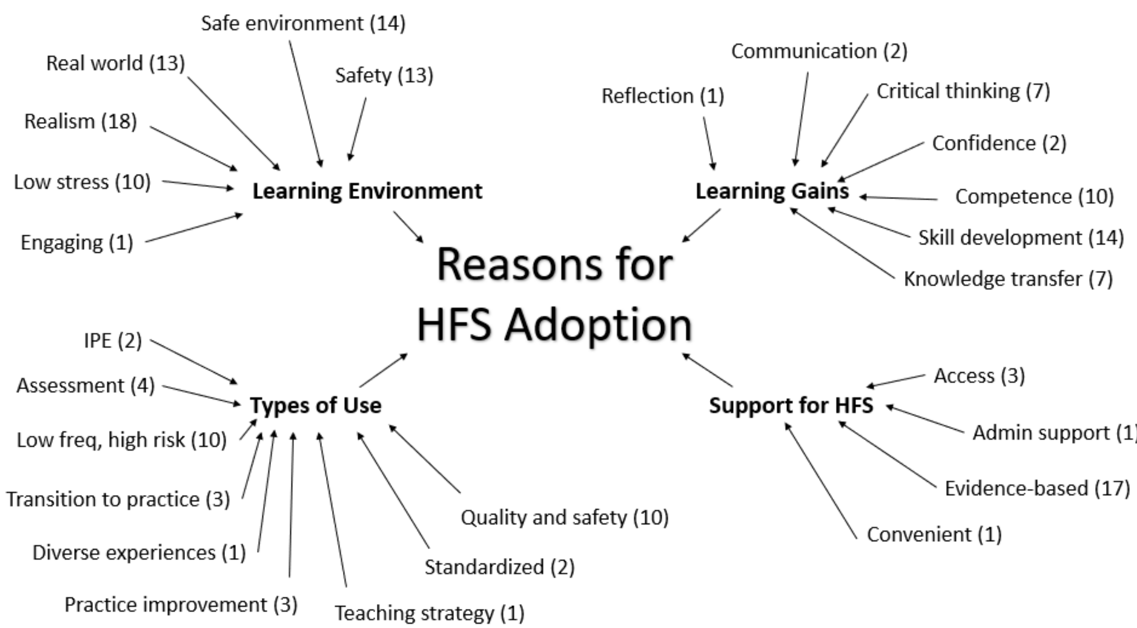

Figure 1. Code Map: Reasons for HFS Adoption. Open codes generated with frequencies linked to four overarching themes as indicated by the categories of learning environment, learning gains, types of use, and support for HFS describe the reasons for HFS adoption by current HFS users.

Learning environment. Participants commented on the safety provided to the learner in the simulated environment noting simulation to be an "effective way of teaching and learning in a realistic looking, safe, nonjudgmental environment." Others commented on the learning environment which protects patients from harm and allows the learner to learn from mistakes:

> "Using high fidelity simulation allows for repeated practice of clinical skills, opportunity to make mistakes and discuss…"
>
> "…allows continuous practice improvement without the fear of patient harm or performance judgement."
>
> "gives nurses an opportunity to learn and make mistakes in a safe environment"

In addition to safety for the learner and safety for the patient the realism of the learning environment was of utmost importance to the respondents which was perceived as significant to the value of simulation.

> "Simulates reality as much as possible but in an organized fashion."
>
> "Realism adds so much depth and quality to the education experience."
>
> "Provides realistic situational learning with great outcomes!"

These perspectives are similar to those in the evidence from the academic realm reporting the learning environment that protects patients from harm, yet allows the learner to practice decision making skills without fear and in a realistic clinical practice environment (Jeffries, 2005; Hughes, 2008; Galloway, 2009; Hayden et al., 2014).

Learning gains. A common theme noted in the reasons for adopting HFS had to do with the evidenced-based gains associated with simulation for healthcare promoting that the "evidence and literature have shown its benefits" and promote that the continued development of competence is paramount: “research has shown that the use of high fidelity simulation improves practice and safety risks.” Others note gains from their experience and/or validated by the research.

> “It’s an evidenced based strategy to help our staff obtain and maintain competence.”
>
> “To enhance confidence, competency, and patient care safety and quality.”
>
> “…provides opportunities for critical thinking and clinical judgment …”
>
> “Incorporates clinical judgement with psychomotor practice.”

Participants reasons for HFS use are indeed validated by the literature and further supported by the IOM in continuing education in the healthcare setting with an aim to prevent errors and improve quality and safety of healthcare (Kohn et al., 2000) due to the evidence-based gains such as self-efficacy (Dunn et al., 2014; Blum et al., 2010; Traynor et al., 2010; Gordon & Budkley, 2009; Delac et al., 2013; van Schaik et al., 2011; Dowson et al., 2013; Wehbe-Janek et al., 2014) and knowledge/skill acquisition (Cooper et al., 2010; Traynor et al., 2010; Partin et al., 2011; Guhde, 2011; Cook et al., 2011; Delac et al., 2013; Boet et al., 2011) for the purpose of practice improvement.

Types of use. Responses from participants varied with respect to use. Some respondents noted their aim was to support nurses’ transition to practice such as the aim of Nurse Residency programs stating they use HFS “in the Transition to Practice to offer a less stressful environment that also offers time to debrief.” This thought is also supported in the literature whereby nurse residency programs aid with transition from novice to expert (Benner, 1982) and incorporate simulation to aid in that process with an aim to support transfer of knowledge to practice (Beyea, Slattery, & von Reyn, 2010).

Participants also noted an aim for HFS use in practiced response to low frequency high risk situations and widespread access to what might otherwise be a rare learning experience if only reliant on real-world presentation.

> "Many of the things I need to teach are either low frequency, high risk or learning directly on a patient would be detrimental to the patient. Using high fidelity simulation allows for repeated practice of clinical skills, opportunity to make mistakes and discuss, and ability to provide the same clinical scenario to multiple groups of learners."
>
> "To improve the accessibility of learning experiences and to enhance the ability of educators to provide diverse educational activities."

While others' aim was more specific to assessment/evaluation of competence stating that HFS "serves also as a validation method for competency." These findings corroborate the evidence promoting use of HFS for the purpose of providing access to low frequency, high risk patient situations that require quick, knowledgeable, and skillful response of the healthcare team (Delac et al, 2013; Duprey, 2019; Crowe et al., 2017; Garcia-Jorda et al., 2019; Kapucu, 2017; Lee et al., 2019). And the literature also provides support for effective competency assessment and extends a link from competency and practice to improved patient outcomes (Lassche & Wilson, 2016).

Support for HFS. Participants also noted support they perceived with regard to adoption of HFS. Of importance, access to the necessary equipment and space in order to conduct HFS learning opportunities were brought out by participants noting, "it was available." Support from stakeholders was also noted by participants as an important reason lending to HFS use:

“full support of hospital leaders”

“Staff love it!”

The evidence from the literature conveys the lack of access and/or support as barriers to adoption (Blake, 2009).

Means of Acquired Knowledge/Skill

HFS users were also asked how they learned to implement HFS. Responses were compiled and analyzed using open and axial coding. Free-text responses from 98.4% (63 participants) were entered in ATLAS.ti. Content analysis via open coding of responses initially elicited 13 codes which were reviewed for redundancy and reduced to 11 codes for axial coding which lead to five categories based on similarities of sources as well as researcher understanding of the available training options: academic, vendor, self-taught, hospital-based, simulation expert (Figure 2).

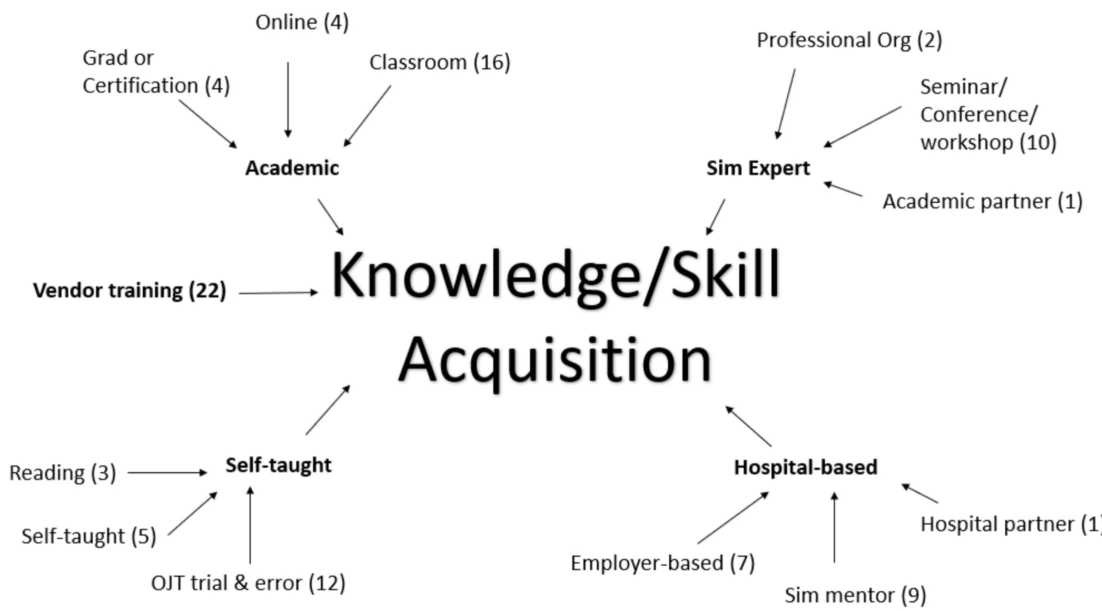

Figure 2. Code Map: Methods to Acquire HFS Knowledge. Open codes generated with frequencies linked to five overarching themes as indicated by the categories of academic,

sim expert, vendor training, self-taught, and hospital-based describe the ways in which current HFS users have acquired the knowledge and skills for simulation implementation.

Academic. One of the most recognized means of knowledge acquisition by HFS users was formal education, either as part of a graduate level program, a simulation certification program, or another simulation program.

"My doctoral project address simulation in orientation."

"Completed University of WA Simulation 101 program"

"extensive graduate studies on simulation"

"debriefing course that was a formal class."

"Certificate program in healthcare simulation"

Vendor. Training provided by the vendor of the simulation equipment, often an additional purchase, was a commonly recognized means of training in preparation for the use of HFS.

"2 day seminar from Laerdal then in person on site hands on learning"

"vendor based training"

"Training from Gaumard for two days when we first purchased our mannequin. On occasion our sales rep. will come and help us troubleshoot mannequin issues."

Self-taught. Participants shared they learned "on-the-job" and without any additional supports.

Hospital-based. Simulationist nurse educators from the hospital setting, including hospital-based partnerships, were identified by HFS users as a training source.

"Mentored by a facility's certified healthcare simulation educator"

"Hospital sponsored simulations classes x 2.

“Simulation courses from other local hospitals”

Simulation expert. External simulation experts were sought out by HBNEs in alignment with their aim to learn more about HFS. This manifested in a variety of ways, from individual training to group training.

“1:1 training with simulation experts.”

“We have simulation lab with full-time staff that help support high fidelity simulation.”

“Training from affiliated academic partners with highly developed simulation programs.”

It was common for HFS users to have received some form of training from the simulation vendor (example: Laerdal, Gaumard, etc.) and/or having formal academic instruction such as part of graduate education or a simulation certification program. Participants often identified more than one learning source:

“Completed University of WA Simulation 101 program as well as two classes on simulation offered by our Simulation department”

“week-long simulation workshop @ASU; review of many articles; hands-on trial and error”

“Training from Simulation Center staff, conferences, Laerdal inservices”

While others identified only a single means of knowledge acquisition. The literature from the hospital setting only minimally discusses the education and training HBNEs using HFS have received, noting that only a few have completed simulation certification programs (Harper, 2018) but not assessing means by which HBNEs have acquired knowledge and skill.

Conclusion

A sample of 128 qualifying HBNEs from 34 states across the U.S. and employed in both rural and urban hospitals completed the survey. Data analysis for hypothesis testing did not reveal any significant differences with regard to the comparison of TR among HBNE that utilize HFS and those that do not. Internal consistency testing of the instrument revealed high reliability with regard to overall TR assessment as well as three of the four dimensions of the assessment. Survey inquiry did reveal additional insights for discussion. HBNEs have a variety of reasons for HFS use streaming from benefits of the learning environment, gains from the learning strategy, types of use, and support received for HFS adoption and use. Further, education/training for simulation skill development does not appear to be standardized and thus may present an opportunity for development with an aim to ensure support of knowledge/skill as well as to include the INACSL standards of best practice (2015). Further, inquiry into the barriers to HFS adoption by HBNEs revealed several opportunities with regard to support and promotion of HFS as a teaching-learning strategy in the post-academic, hospital-based setting for continuing education/training of healthcare professionals. Discussion of the results, limitations of the study, and implications for future research are shared in Chapter five.

CHAPTER 5 – DISCUSSION

This study used a cross-sectional survey design in an aim to compare TR of HBNEs that use HFS and those that do not, in order to determine if a difference in TR might account for the lack of widespread adoption of HFS. An online survey was administered to HBNEs from two national organizations: ANPD and SSH. Quantitative data were collected with additional qualitative responses to further the understanding of the HBNEs' perspectives and experiences. Hypothesis testing using TR scores did not result in rejection of the null hypotheses as statistically significant differences among the two groups with regard to TR were not revealed at an $\alpha < .05$. However, implications of the findings lend to the body of knowledge as TR scores indicate that HBNEs appear to be a techno-ready population. Further, additional insights were gained from responses in the survey with respect to HBNE desire to learn about HFS practices, barriers to adoption, and supports that have aided in HFS adoption. Each will be discussed in this chapter. Limitations of the study along with recommendations for future research will also be considered.

Image of the HBNE

Findings of this study indicate that the average HBNE using HFS is a female of 45-46 years of age with a master's degree, 10-14 years of professional nursing experience, and less than five years of experience as a nurse educator. The typical HBNE likely has a greater than average level of TR as compared to the general population. Specific to the HBNE population that uses and/or desires to learn how to implement HFS, it appears there's at least a general awareness of the academic evidence supporting HFS, and HFS users also have had some level of training, whether it be from workshops, certifications, formal education, or in partnership with an experienced simulationist. In comparison, Duvall's (2012) study of academic nurse educators depicts an image of the average academic nurse educator using HFS as a "51 year-old female, Caucasian who has a master's in nursing … has been a nurse for 30+ years … has been teaching for 5-10 years … self-identified novice who learned to operate the simulator on-the-job" (p. 64). The lack of vast difference among educator profiles may suggest that it is plausible to translate the findings from the academic setting to the hospital setting with regard to educator adoption of HFS, however, additional study of the hospital-based adoption and implications of HFS is warranted.

Related, this study found that the HBNE using simulation were more likely to hold a master's or terminal degree in comparison to the HBNE not using simulation who are more likely to hold a bachelor's or master's degree (Table 2). This could be a limitation of the sample, related to greater exposure to research during advanced education, or exposure to simulation in more graduate programs. Further inquiry into this realm may reveal insights that could inform faculty in higher education when planning curricular changes, such as in a graduate education program (MSN or post-graduate specialization) or a Doctor of Nursing practice (DNP) program.

Implications for Hospital-Based Education

Quantitative data obtained from the TRI 2.0 instrument did not reveal statistically significant differences in TR & the four dimensions (optimism, innovativeness, discomfort, and insecurity) among HBNEs. These results differed from previous study of academic nurse educators whereby statistically significant differences in the TR dimensions of optimism and innovation were reported among academic nurse educators using HFS and those not using HFS (Petersen, 2008). However, this study does validate past findings with regard to a lack of differences in overall TR among academic nurse educators (Petersen, 2008; Duvall, 2012), now extended to HBNEs. This is a reassuring discovery. For directors of education departments as well as hospital administrators, it is useful to understand the general propensity for technology adoption prior to making a long-term investment in a teaching-learning technology such as HFS. In fact, findings from this study hold implications in decisions made by simulation champions/trainers and HBNEs in addition to hospital administrators and education directors.

Implications for Hospital Administrators

Participants in this study identified cost and access as key challenges/barriers to HFS implementation. Hospital administrators have a responsibility to ensure fiscal responsibility of the organization while providing quality healthcare to the population which it serves. Financial wellbeing of the organization is a priority because the hospital must not only pay salaries to the individuals employed, but also maintain facilities, etc., not to mention to grow innovation and expand access to care (Brown & Falk 2013). In turn, cost is a factor that every hospital administrator must take into account when considering new ventures. The return on investment (ROI) is considered anytime a new operating expense is brought to light. In some cases, the anticipated ROI isn’t significant, and the proposal is declined; other times, the anticipated ROI is high and thus approved for funding. This is how the cost of HFS must be examined by hospital administrators, however, in order to ensure a comprehensive ROI analysis, educators and/or the education director must have a seat at the table.

Risk management is an area of healthcare where the ROI is or should be closely scrutinized (Brown & Falk, 2013). The expense associated with medical errors can be quite extensive, and thus, detrimental to the bottom line as well as harmful to the reputation of a healthcare organization. The gains of simulation have been associated with perceived improved patient outcomes (Goldshtein, Krensky, Doshi, & Perelman, 2020). But simulation technology comes with a cost and building a sustainable simulation center is an even greater investment. To this regard, hospital administrators should consider establishing partnership(s) with academic institutions or other hospitals in order to share the investment while benefiting from the teaching-learning strategy. In this way, barriers to access are not eliminated, but minimized, and financial investment may be divided.

Implications for Directors of Education

Education department directors and/or Vice Presidents (VPs) of hospital education reached out during the survey process to request that the researcher share findings from the study. This study helps to inform decisions and recommendations that directors and VPs will take forward in communications with hospital administrators. Strategic aims for success and growth of the education department will be better informed as a result of this study.

The hospital-based education director should take findings from this study under consideration and seek to break down barriers to HFS adoption as a means to innovate hospital-based education/training that will lend to improved healthcare quality and safety. Key barriers to HFS adoption identified in this study include cost, assess, HBNE knowledge/skill, and support from administration. Ultimately responsible for the continued education and training of the healthcare team in turn, impacting patient outcomes, the education director is the most informed with regard to teaching-learning strategies in alignment with desired learning outcomes. Thus, is the expert sought out by the hospital administrators to advise on educational strategy in relation to the strategic initiatives of the organization with aims for high quality and safety of the care provided to patients.

With further aim to break down barriers, the education director should seek to build collaborative relationships with academic partners. The hospital and academic organization can both benefit from the partnership; the hospital will benefit from sharing in the use of the simulation facilities as well as expertise of academic simulationists while the academic faculty and students will benefit from the real-world expertise of the hospital educators and healthcare team (Senger, Stapleton, & Gorski, 2012).

The education director should also take into consideration training needs of the HBNEs with an understanding of the benefits of investing in a sustainable, continuing simulation training plan that will support initial HBNE knowledge and skill as well as further expand confidence, professional growth and development, in order to advance the HBNE from simulation novice to expert (Thomas & Kellgren, 2017) and to improve the ROI.

Finally, among implications for directors of education departments is the need for continued assessment and awareness of HBNE TR as a high population of "avoiders" and "hesitators" among HBNEs in an organization may impede technological advancement such as HFS adoption given these low TR populations need extra support and reassurance (Parasuraman & Colby, 2015). Those with high TR will be the trendsetters and also may be the best to provide ongoing support and reassurance to HBNEs with lower TR. This further carries over to the hiring process when seeking new HBNEs. Use of behavioral questioning during the interview process with an aim to ascertain the candidate's level of TR and desire for innovation, specifically simulation technology, will help to differentiate among multiple candidates (Bailey, 2013). In this way, the director may select HBNEs who will support innovation and contribute to the growth of the education department; ultimately, influencing the quality and safety of the care provided by the healthcare team. A clearer understanding of the classifications will further aid in an understanding of the behaviors to assess for during the interview process.

TR classification of HBNEs and significance. Parasuraman and Colby developed a classification system, "based on the distinct combinations of technology-related beliefs" (2015, p. 71). The five classifications with descriptions are as follows:

> "Skeptics" – tend to have a detached view of technology, with less extreme positive and negative beliefs
>
> "Explorers" – tend to have a high degree of motivation and a low degree of resistance
>
> "Avoiders" – tend to have a high degree of resistance and low degree of motivation
>
> "Pioneers" – tend to hold both strong positive and negative views about technology
>
> "Hesitators" – stand out due to their low degree of innovativeness. (Parasuraman & Colby, 2015, p. 71)

Table 12 demonstrates the distribution of HBNEs among the five classifications in comparison to the current U.S. adult population normative data provided by Dr. Colby (personal communication, September 7, 2020). In comparison to U.S. normative data, it appears that HBNEs have a higher propensity for technology adoption. Further, there are far fewer HBNEs identified as "avoiders," a subset of HBNEs less apt to adopt HFS.

Table 12.

HBNE Classifications & Comparison with U.S. Norms

Classifications	Frequency	Percent	2020 U.S. Norm
Skeptics	45	35.2%	35.8%
Explorers	58	45.3%	16.7%
Avoiders	3	2.3%	14.6%
Pioneers	15	11.7%	18.8%
Hesitators	7	5.5%	14.0%
Total	128		

Note. 2020 U.S. Normative data provided by Colby (personal communication, September 7, 2020)

The majority of HBNEs are identified as "explorers" (45.3%) as compared to the U.S. normative data whereby the majority of consumers are "skeptics" (35.8%) (Colby, personal communication, September 7, 2020) suggesting that HBNEs generally have higher TR tendencies as compared to the general consumer population. Based on their research, Parasuraman and Colby (2015) liken explorers to the "early adopter explorers" whereby explorers have a higher tendency for interest in technologies, are more likely to work with technology in their profession, and a higher propensity for adoption of new technologies. These HBNEs are the trendsetters; they are likely the educators who return from a conference or workshop with great excitement after having learned about HFS from other educators. They are interested, willing, and eager to implement HFS or have already. The “explorers” may quickly become the cheerleaders for HFS and encourage or even mentor others toward adoption of HFS.

The next populous classification among the HBNEs in this study is that of “skeptics” (35.2%). Identified as having fewer extreme beliefs (Parasuraman & Colby, 2015), these HBNEs have cautious interest in HFS. The “skeptics” may be convinced to adopt HFS with evidence of gains associated with HFS and/or guided experiential opportunities (Parasuraman & Colby, 2015).

The HBNE “pioneers” made up only 11.7% of the sample. These are the individuals that fearlessly lead the charge in implementation – the few, but fierce adopters. “Hesitators” made up only 5.5% of the respondents and “avoiders” 2.3%. According to Parasuraman and Colby (2015), “low-TR customers (the “avoiders” and “hesitators”) will be more satisfied with basic functionality but will need more support and reassurance” (p. 72). Given the majority of HBNEs fall into the evidence-based classifications of “explorers” who have a high TR and may be quick to move to advanced use of HFS, the few “hesitators” and “avoiders” may be successfully mentored by “explorers.”

Categorical classification and comparison to the current U.S. normative data, seems to indicate that HBNEs have a good deal of momentum with regard to TR (propensity for technology adoption) to the extent that intrinsic TR among HBNEs is not likely the common barrier to HFS adoption. However, that does not mean that qualities of TR are equal among all HBNEs. For the hospital-based education director who is looking to initiate or advance HFS-based continuing education/training, it will be helpful to take these characteristics into consideration and seek out candidates that will align with the aims of the department and the organization.

Implications for Simulation Champions/Trainers

Simulation champions and/or trainers of new and emerging simulationists must be aware of their audience with respect to variations in readiness. They must recognize that it is not a simple question of like or dislike, but a true propensity for technology adoption and use, specifically simulation technologies coupled with desire and access, that will aid in HFS adoption. HBNEs in this study, as representatives of the HBNE population, show a general propensity for technology adoption, however there are variations within the levels of propensity as evidenced by a strata across adoption classifications of hesitators, pioneers, avoiders, explorers, and skeptics; more heavily represented by explorers and skeptics, and taking into consideration that the majority want to learn about HFS. This has implications for decision making with regard to planning educational/training sessions.

The simulation champion/trainer should consider strategies aimed at increasing optimism, and innovation (Demirci et al., 2008; Petersen, 2008; Kuo et al., 2013) in order to move skeptics and hesitators toward adoption; strategies to improve motivation, buy-in, and excitement (Atkinson, 2008; Hanburg, 2008; Jansen et al., 2010) in avoiders and raise awareness among skeptics in order to move them toward adoption and use of HFS. This thought is supported by Rogers Diffusion of Innovation Theory (1962, 2003) as well as the recommendations by Petersen (2008) for building TR.

Implications for HBNEs

This study informs HBNEs with regard to the dimensions of TR and dispels the myth that nurse educators do not hold a propensity for technology adoption. In fact, it would appear that many do have a moderate to high level of TR and thus a propensity for technology adoption along with desire. Variations in dimensions of TR do exist among HBNEs and thus it is important to recognize that each educator may possess varied levels of optimism, innovativeness, discomfort, and insecurity. However, the desire to adopt HFS may be the key to HBNE innovation with regard to continuing education/training in the hospital setting. HBNEs must use that desire to drive inquiry; learn about HFS from the literature, see a simulation champion or mentor, ask questions, admit fears or concerns, and feed curiosities; anxiety and fear can be overcome with standardized education.

For HBNEs using simulation, take into consideration that there are HBNEs who would very much like to use HFS, though currently do not have the support of administration, funding, access, or knowledge/skills. Seek these educators out and partner with them in order to help to build motivation and knowledge. Share strategies aimed to garner the support and funding from the administration and help to break down barriers to HFS adoption and use in continuing education/training in the hospital setting.

Promote the reasons for adoption of HFS and the gains that have been realized by you and your organization as a result of HFS implementation. One way to do this is by conducting HFS research in the hospital setting and then publish the results; share these experiences and results with other HBNEs, education directors, and hospital administrators in order to raise awareness and promote buy-in. Work with administrators to ensure full recognition of the return on investment realized as a result of HFS adoption. In turn, seek a seat at the table and prompt discussion with an aim to break down barriers to HFS adoption and use in the hospital setting.

Limitations

Convenience sampling is often viewed as a limitation of the study as it can be difficult to generalize findings to the population. Perhaps the lack of significant difference is a sign of general propensity for use of simulation technology among the nurse educators, however limited by other variables such as organizational readiness, support, perception of value/perceived ROI, personal knowledge and comfort with design and implementation of HFS, etc. This finding is similarly supported in the literature. In a study by Blake (2009), the majority of academic educators held positive attitudes toward technology, though academic educators noted barriers to include lack of support and guidance along with equipment. Findings of Dowie and Phillips (2011) included a lack of self-confidence. Savery (2002) also reported findings of confidence with basic technologies, however a need for faculty training with respect to more advanced technologies. Thus, the lack of significant difference could be due to a limitation of the sample. In an effort to obtain access to a nationwide sample that would be representative of the population, HBNEs were recruited from two professional organizations: ANPD and SSH. In this manner, a sample of HBNEs from diverse geographical and varied types of hospitals was obtained. However, it’s possible that the members of the SSH and ANPD are generally more techno-savvy and innovative in comparison to non-members. An additional limitation of the sampling procedure used in this study is the small response from HBNEs in rural-based hospitals as less than 19% of respondents were from rural locations where technology may be more limited and thus this population may be underrepresented. This may lend to greater generalization of findings to HBNEs practicing in urban hospitals; lesser so to HBNEs practicing in rural hospitals.

The electronic distribution of the survey was selected given a general assumption that the general nursing population possess a basic knowledge of the internet and thus would be able to access and complete an online survey. This assumption was made based on the Technology Informatics Guiding Educational Reform (TIGER) Informatics Competencies Collaborative (TICC) Final Report published in 2009 in which foundational informatics competencies for all practicing nurses were outlined. Among the three categories of competence (basic computer competencies, information literacy, and information management), web browsing, and communication was included as a basic computer competency for all nurses, not limited to informatics specialists (TICC, 2009). However, HBNEs with higher TR may use these technologies more readily in comparison to those with lower TR.

Suggestions for Future Research

Further inquiry into the potential barriers to adoption and use of HFS in hospital-based continuing education/training is needed. Participants in this study noted financial support, access, knowledge/skill, and support of the administration among the barriers for HFS adoption and use.

A support system for adoption of HFS is needed in order to further the use of HFS in hospital-based continuing education/training in alignment with recommendations of the IOM (Kohn et al., 2000). Given the comparison to the U.S. normative data, HBNEs appear to have an overall higher propensity for technology as compared to the general population. HBNEs have a fair level of TR and many non-HFS user participants noted an interest in adoption of HFS as a teaching/learning strategy, however limited by cost, access, and support of the hospital administration. Perhaps inquiry into organizational readiness factors may reveal barriers to HFS adoption and thus opportunities to mitigate. As an element of an organizational readiness assessment, hospital administrators' TR and perceptions of innovations such as HFS, can be determined. Hospital administrators have an impact on the adoption and use of HFS, given they have strong influence over the culture and perceived values within the organization through strategic planning. Additionally, they control the budget and thus funding allocation for continuing education/training of the healthcare professionals they employ. For this reason, inquiry into perceptions of hospital administrators and a comparison of TR among hospital administrators of organizations that use HFS and those that do not, may reveal greater insight with regard to a population that influence and control the strategic initiatives.

It is recommended that future research include an inquiry into organizations that have adopted HFS with an aim to examine retrospective ROI analysis. Findings from comparison of pre-implementation ROI (anticipated) and post-implementation ROI (actual) may be very telling with regard to the organizational gains. This type of evidence may help to further HFS adoption among hospitals by gaining buy-in from administrators. Future inquiry may be supported through adoption of a standard ROI methodology such as the framework for determining the monetary ROI of simulation-based training identified by Bukhari, Andreatta, Goldiez and Rabelon (2017). Both quantitative and qualitative benefits should be considered. Qualitative benefits can be difficult to monetize, though should not be overlooked. Bukhari et al. note, “Understanding the real ROI and value of medical training, including highly effective simulation-facilitated methods, provides a foundation for fostering investment in best practices that have a positive impact on patient safety and quality of care” (2017, p.7) .

Summary

This study provides an important contribution to the body of knowledge specific to post-academic adoption of HFS in healthcare as the study examined differences in TR among HBNEs that use HFS and HBNEs that do not use HFS. Findings from the study indicate that HBNEs are generally techno-ready, more so in comparison with the general U.S. population. TR is not likely the limiting factor in HFS adoption and use and, in fact, many HBNEs not using HFS have a desire to do so; a reassuring finding. However, inquiry also brought about findings with regard to barriers to HFS adoption and use including cost, access, knowledge/skill, and support of the hospital administration. Continued inquiry into the barriers for HFS adoption is suggested.

Among the recommendations based on the findings of this study, TR characteristics should be taken into consideration when hiring HBNEs with an aim to align the education department with the strategic initiatives of the hospital. Additionally, nursing education must be at the table and sought out by hospital administration when strategic decisions are being made. In this way, the education and the innovative strategies to support the training of the healthcare team does not become an afterthought, but instead, is intentionally aligned to achieve desired outcomes. It is necessary to have a purposeful plan for HBNE education and training on HFS in order to capitalize on hospital-based continuing education/training. HBNEs must be armed with knowledge and confidence in order to innovate and promote advancement of HFS in continuing education/training of healthcare professionals as well as quality and safety of healthcare.

REFERENCES

Aebersold, M., (2018, April). Simulation-Based Learning: No Longer a Novelty in Undergraduate Education. *OJIN: The Online Journal of Issues in Nursing, 23*(2). DOI: 10.3912/OJIN.Vol23No02PPT39.

Advisory Committee on Interdisciplinary, Community-Based Linkages (ACICBL). (2011). *Continuing Education, Professional Development, and Lifelong Learning for the 21st Century Health Care Workforce.* Washington D.C.; HRSA. Retrieved from HRSA website: https://www.hrsa.gov/advisorycommittees/bhpradvisory/acicbl/Reports/eleventhreport.pdf.

Agency for Healthcare Research and Quality (AHRQ). (2019, January). *Failure to rescue.* Patient Safety Network. Retrieved February 3, 2019 from the AHRQ website: https://psnet.ahrq.gov/primers/primer/38/failure-to-rescue.

Andreatta, P., Saxton, E., Thompson, M., & Annich, G. (2011). Simulation-based mock codes significantly correlate with improved pediatric patient cardiopulmonary arrest survival rates. Pediatric *Critical Care Medicine, 12*, 33–38. doi: 10.1097/PCC.0b013e3181e89270.

Ashrafzadeh, A. & Sayadian, S. (2015). University instructors' concerns and perceptions of technology integration. *Computers in human behavior, 49*, 62-73. Doi: http://dx.doi.org/10.1016/j.chb.2015.01.071.

Association for Nursing Professional Development (ANPD) Public Policy Committee (PPC). (2013). *Role of nursing professional development in helping meet Institute of Medicine's Future of Nursing recommendations.* Chicago, IL: Author.

Association for Nursing Professional Development (ANPD). (2020). About ANPD. Retrieved March 24, 2020 from ANPD website: https://www.anpd.org.

Bailey, L. (2013, May 29). *Best practices for Medical Simulation Hiring*. Healthy Simulation. Retrieved from https://www.healthysimulation.com/3991/best-practices-for-medical-simulation-hiring/.

Baker, C., Pulling, C., McGraw, R., Dagnone, J.D., Hopkins-Rosseel, D., & Medves, J. (2008, November). Simulation in interprofessional education for patient-centered collaborative care. *Journal of Advanced Nursing. 64*(4), 372-379. DOI: 10.1111/j.1365-2648.2008.04798.x.

Bambini, D., Washburn, J., & Perkins, R. (2009). Outcomes of clinical simulation for novice nursing students: Communication, confidence, clinical judgment. *Nursing Education Perspectives, 30*(2), 79-82.

Banks, S., Stanley, M. J., Brown, S., & Matthew, M. (2019). Simulation-based interprofessional education: A nursing and social work collaboration. *Journal of Nursing Education*, *58*(2), 110-113.

Barra, M. & Singh Hernandez, S. S. (2019). No room at the inn: Use of maternal ‐ child simulation when hospital clinical is restricted. *Nursing Forum, 54,* 23-29. DOI: 10.1111/nuf.12293.

Benner, P. (2001). *From novice to expert: Excellence and power in clinical nursing practice.* New Jersey: Prentice Hall.

Beyea, S. C., Slattery, M. J., & von Reyn, L. J. (2010). Outcomes of a simulation-based nurse residency program. Clinical Simulation in Nursing, 6(5), e169-e175. https://doi.org/10.1016/j.ecns.2010.01.005.

Blake, H. (2009). Staff perceptions of e-learning for teaching delivery in healthcare. *Learning in Health and Social Care, 8*(3), 223-234. Doi: 10.1111/j.1473-6861.2009.00213.x.

Blair, E. (2015). A reflexive exploration of two qualitative data coding techniques. *Journal of Methods and Measurement in the Social Sciences, 6*(1), 14-29.

Blum, C.A., Borglund, S., & Parcells, D. (2010). High-fidelity nursing simulation: impact on student self-confidence and clinical competence. *International Journal of Nursing Education Scholarship, 7*(1), 14.

Boet, S., Borges, B.C.R., Naik, V.N., Siu, L.W., Reim, N., Chandra, D., Bould, M.D., & Joo, H.S. (2011). Complex procedural skills are retained for a minimum of 1 yr after a single high-fidelity simulation training session. *British Journal of Anaesthesia*, 107(4), 533–539. DOI: https://doi.org/10.1093/bja/aer160.

Botma, Y. (2014). Nursing student's perceptions on how immersive simulation promotes theory-practice integration. *International Journal of Africa Nursing Sciences, 1*, 1-5. https://doi.org/10.1016/j.ijans.2014.04.001.

Braddock, C. H., Szaflarski, N., Forsey, L., Abel, L., Hernandez-Boussard, T., & Morton, J. (2015). The TRANSFORM Patient safety project: a microsystem approach to improving outcomes on inpatient units. *Journal of General Internal Medicine, 30*, 425–433. doi: 10.1007/s11606-014-3067-7

Brown, B. & Falk, L. H. (2013, November 19). How to drive ROI in your healthcare improvement projects (Executive Report). Health Catalyst. Retrieved from https://www.healthcatalyst.com/how-to-drive-roi-in-your-healthcare-improvement-projects-html.

Brown, S. R. (2013). *A comparison of Tennessee state board of nursing pass rates for associate and baccalaureate degree nursing programs five years before and five years after integration of high-fidelity simulation into the nursing curriculum* (Dissertation, Union University, TN).

Bukhari, H., Andreatta, P., Goldiez, B., & Rabelo, L. (2017). A framework for determining the return on investment of simulation-based training in health care. *The Journal of Health Care Organization, Provision, and Financing, 54*, 1-7. https://doi.org/10.1177/0046958016687176.

Bultas, M. W., Hassler, M., Ercole, P. M., & Rea, G. (2014). Effectiveness of high-fidelity simulation for pediatric staff nurse education. *Pediatric Nursing, 40*(1), 27-42.

Cain, C.L., Riess, M.L., Gettrust, L., & Novalija, J. (2014). Malignant hyperthermia crisis: optimizing patient outcomes through simulation and interdisciplinary collaboration. *AORN Journal, 99*(2), 300-311.

Caison, A.L., Bulman, D., Pai, S., & Neville, D. (2008). Exploring the technology readiness of nursing and medical students at a Canadian University. Journal of Interprofessional Care, 22(3), 283-294. DOI: 10.1080/13561820802061809

Cook, D.A., Hatala, R., Brydges, R., Zendejas, B., Szostek, J.H., Wang, A.T., Erwin, P.J., & Hamstra, S.J. (2011). Technology-enhanced simulation for health professions education. *Journal of the American Medical Association, 306*(9), 978-988.

Cooper, S., Kinsman, L., Buykx, P., McConnell-Henry, T., Endacott, R., & Scholes J. (2010). Managing the deteriorating patient in a simulated environment: Nursing students' knowledge, skills and situation awareness. *Journal of Clinical Nursing, 19*, 2309-2318. Doi: 10.1111/j.1365-2702.2009.03164.x.

Creswell, J. W. (2008). *Planning, conducting, and evaluating quantitative and qualitative research*. Upper Saddle River, NJ: Pearson.

Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). Los Angeles, CA: Sage.

Crowe, S., Ewart, L., & Derman, S. (2018). The impact of simulation based education on nursing confidence, knowledge and patient outcomes on general medicine units. *Nurse Education in Practice, 29*, 70-75. Doi: https://doi.org/10.1016/j.nepr.2017.11.017.

Dahiru, T. (2008). P-value a true test of statistical significance? A cautionary note. *Annals of Ibadan Postgraduate Medicine, 6*(1), 21-26.

Daley, B. J. (2004). *Using concept maps in qualitative research.* Paper presented at the First International Conference on Concept Mapping, Pamplona, Spain. Retrieved from http://cmc.ihmc.us/papers/cmc2004-060.pdf.

Delac, K., Blazier, D., Daniel, L., & N-Wilfong, D. (2013). Five alive, using mock code simulation to improve responder performance during the first 5 minutes of a code. *Critical Care Nursing, 36*(2), 244-250. doi: 10.1097/CNQ.0b013e3182846f1a.

Demirci, A. E. & Ersoy, N. F. (2008). Technology readiness for innovative high-tech products: How consumers perceive and adopt new technologies. *The Business Review, 11*(1), 302-310.

Dillard, N., Sideras, S., Ryan, M., Carlton, K.H., Lasater, K., & Siktberg, L. (2009). A collaborative project to apply and evaluate the clinical judgement model through simulation. *Nursing Education Perspectives, 30*(2), 99-104.

Dillon, P.M., Noble, K.A., & Kaplan, W. (2009). Simulation as a means to foster collaborative interdisciplinary education. *Nursing Education Perspectives, 30*(2), 87-90.

Dowie, I., & Phillips, C. (2011, August 10). Supporting the lecturer to deliver high-fidelity simulation. *Nursing Standard*, *25*(49), 35-40.

Dowson, A., Russ, S., Sevdalis, N., Cooper, M. & De Munter, C. (2013). How in situ simulation affects paediatric nurses' clinical confidence. *British Journal of Nursing*, *22*(11), 610-616.

Dunn, K. E., Osborne, C., & Link, H. J. (2014). High-fidelity simulation and nursing student self-efficacy: Does training help the little engines know they can? *Nursing Education Perspectives, 35*(6), 403-404.

Duprey, M. D. & Silver Dunker, K. (2019). Megacode simulation training in undergraduate nursing education. *Nursing Education Perspectives*. doi: 10.1097/01.NEP.0000000000000589.

Duvall, J.J. (2012). *Motivation and technological readiness in the use of high-fidelity simulation: A descriptive comparative study of nurse educators* (Doctoral dissertation). Retrieved from ProQuest. UMI: 3550035.

Etikan, I., Musa, S.A., & Alkassim, R.S. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics, 5*(1), 1-4. Doi: 10.11648/j.ajtas.20160501.11.

Fawaz, M. & Anshasi, H. A. (2019). Senior nursing student's perceptions of an interprofessional simulation-based education (IPSE): A qualitative study. *Heliyon, 5*(10). DOI: https://doi.org/10.1016/j.heliyon.2019.e02546.

Fero, L. J., O'Donnell, J. M., Zullo, T. G., Dabbs, J., Kitutu, A. D., Samosky, J. T., & Hoffman, L. A. (2010). Critical thinking skills in nursing students: Comparison of simulation-based performance with metrics. *Journal of Advanced Nursing, 66*(10), 2182-2193. https://doi.org/10.1111/j.1365-2648.2010.05385.x.

Freytag, J., Stroben, F., Hautz, W.E., Eisenmann, D., & Kämmer, J.E. (2017). Improving patient safety through better teamwork: how effective are different methods of simulation debriefing? Protocol for a pragmatic, prospective and randomized study. *British Medical Journal, 7*. Doi: 10.1136/bmjopen-2017-015977.

Gaba, D. M. (2007). The future vision of simulation in healthcare. *The Journal of the Society for Simulation in Healthcare, 2*(2), 126-135. Doi: 10.1097/01.SIH.0000258411.38212.32.

Galloway, S. J. (2009, May 31). Simulation techniques to bridge the gap between novice and competent healthcare professionals. *The Online Journal of Issues in Nursing, 14*(2), DOI: 10.3912/OJIN.Vol14No02Man03.

Garcia-Jorda, D., Walker, A., Camphaug, J., Bissett, W., Spence, T., Martin, D. A., Lin, Y., et al. (2019). Bedside chest compression skills: Performance and skills retention in in-hospital training pediatric providers. A simulation study. *Journal of Critical Care, 50*, 132-137. https://doi.org/10.1016/j.jcrc.2018.11.033.

Ghaferi, A.A., & Dimick, J.B. (2016). Importance of teamwork, communication and culture on failure-to-rescue in the elderly. *British Journal of Surgery, 2016*(103), e47-e51.

Goforth, C. (2015, November 16). *Using and interpreting Cronbach's Alpha*. Retrieved from the University of Virginia Library website: https://data.library.virginia.edu/using-and-interpreting-cronbachs-alpha/.

Goldshtein, D., Krensky, C., Doshi, S., & Perelman, V. S. (2020). In situ simulation and its effects on patient outcomes: a systematic review. *BMJ Simulation and Technology Enhanced Learning, 6*, 3–9. doi:10.1136/bmjstel-2018-000387.

Gordon, C.J., & Buckley, T. (2009, November). The effect of high-fidelity simulation training on medical-surgical graduate nurses' perceived ability to respond to patient clinical emergencies. *Journal of Continuing Education in Nursing, 40*(11), 491-500.

Grady, J.L., Kehrer, R.G., Trusty, C.E., Entin, E.B., Entin, E.E., & Brunye, T.T. (2008, September). Learning nursing procedures: The influence of simulator fidelity and student gender on teaching effectiveness. *Journal of Nursing Education, 47*(9), 403-408. DOI: 10.3928/01484834-20080901-09.

Gravetter, F.J. & Wallnau, L.B. (2009). *Statistics for the behavioral sciences, 8th Edition.* Belmont, CA: Wadsworth, Cengage Learning.

Guhde, J. (2011, February). Nursing students' perceptions of the effect on critical thinking, assessment, and learner satisfaction in simple versus complex high-fidelity simulation scenarios. *Journal of Nursing Education, 50*(2), 73-78. DOI: 10.3928/01484834-20101130-03.

Habibli, T., Ghezeljeh, T. N., & Haghani, S. (2020). The effect of simulation-based education on nursing students' knowledge and performance of adult basic cardiopulmonary resuscitation: A randomized clinical trial. *Nursing Practice Today, 7*(2), 87-96.

Harper, M. G., Gilbert, E. G., Gilbert, M., Markey, L., & Anderson, K. (2018). Simulation use in acute care hospitals in the United States. *Journal for Nurses in Professional Development, 34*(5), 242-249. DOI: 10.1097/NND.0000000000000472.

Hayden, J., Smiley, R., Alexander, M., Kardong- Edgren, S., & Jeffries, P.R. (2014). The NCSBN national simulation study: Replacing clinical hours with simulation in pre-licensure nursing education. *Journal of Nursing Regulation, 5*(2), 61-64.doi:10.1016/S21558256 (15)303355.

Hughes, R.G. (ed.). (2008, March). *Patient safety and quality: An evidence-based handbook for nurses*. (Prepared with support from the Robert Wood Johnson Foundation). AHRQ Publication No. 08-0043. Rockville, MD: Agency for Healthcare Research and Quality.

Holcomb, J. B., Dumire, R. D., Crommett, J. W., Stamateris, C. E., Fagert M. A. et al. (2002). Evaluation of trauma team performance using an advanced human patient simulator for resuscitation training. *The Journal of TRAUMA Injury, Infection, and Critical Care, 52*(6), 1078-1086.

Hollema, C. (2015). Faculty development in high fidelity clinical simulation. International Journal of Nursing Didactics, 5(9). DOI: https//doi.org/10.15520/ijnd.2015.vol15.iss9.110.01-05.

Hooper, D., Coughlan, J., & Mullen, M.R. (2008). Structural equation modelling: Guidelines for determining model fit. *The Electronic Journal of Business Research Methods, 6*(1), 53 – 60. Retrieved from www.ejbrm.com.

INACSL Standards Committee. (2016, December). INACSL standards of best practice: Simulation[SM] Simulation Design. *Clinical Simulation in Nursing, 12*(S), S5-S12. http://dx.doi.org/10.1016/j.encs.2016.09.005.

Janse van Vuuren, V., Seekoe, E., & Goon, D. T. (2018). The perceptions of nurse educators regarding the use of high fidelity simulation in nursing education. *Africa Journal of Nursing and Midwifery, 20*(1). https://doi.org/10.25159/2520-5293/1685.

Jansen, D. A., Berry, C., Brenner, G. H., Johnson, N., & Larson, G. (2010). A collaborative project to influence nursing faculty interest in simulation. *Clinical Simulation in Nursing, 6,* e223-e229. doi: 10.1016/j.ecns.2009.08.006.

Jansen, D. A., Johnson, N., Larson, G., Berry, C., & Brenner, G. H. (2009). Nursing faculty perceptions of obstacles to utilizing manikin-based simulations and proposed solutions. *Clinical Simulations in Nursing, 5,* e9-e16. doi: 10.1016/j.ecns.2008.09.004.

Jeffries, P. (2005). A framework for designing, implementing, and evaluating simulations used as teaching strategies in nursing. *Nursing Educations Perspectives, 26,* 96–103.

Kapucu, S. (2017). The effects of using simulation in nursing education: A thorax trauma case scenario. *International Journal of Caring Sciences, 10*(2), 1069-1074.

Kim, S. H., Issenberg, B., & Roh, Y. S. (2020, May). The effects of simulation-based advanced life support education for nursing students. *CIN: Computers, Informatics, Nursing, 38*(5), 240-245. DOI: 10.1097/CIN.0000000000000560.

Knight, L. J., Gabhart, J. M., Earnest, K. S., Leong, K. M., Anglemeyer, A. & Franzon, D. (2014). Improving code team performance and survival outcomes. *Critical Care Medicine, 42*, 243–251. doi: 10.1097/CCM.0b013e3182a6439d.

Kohn, L.T., Corrigan, J.M., & Donaldson, M.S. (eds). (2000). *To err is human: building a safer health system A report of the Committee on Quality of Health Care in America, Institute of Medicine.* Washington, DC: National Academy Press.

Krueger-Ray, S. (2017). Issues related to implementing high-fidelity simulation in a nursing program (Doctoral dissertation, Walden University). Retrieved from https://scholarworks.waldenu.edu/cgi/viewcontent.cgi?article=6032&context=dissertations.

Kuo, K. M., Liu, C. F., & Ma, C. C. (2013). An investigation of the effects of nurses' technology readiness on the acceptance of mobile electronic medical record systems. *BMC Medical Informatics & Decision Making, 13*(80).

Laschinger, S., Medves, J., Pulling, C., McGraw, R., Waytuck, B., Harrison, M. B., & Gambeta, K. (2008). Effectiveness of simulation on health profession students' knowledge, skills, confidence and satisfaction. *International Journal of Evidence Based Healthcare, 6*, 278-302. Doi: 10.1111/j.1479-6988.2008.0018.x.

Lassche, M. & Wilson, B. (2016). Transcending competency testing in hospital-based simulation. *AACN Advanced Critical Care, 27*(1), 96-102.

Lavrakas, P. J. (2008). *Encyclopedia of survey research methods*. Thousand Oaks, Calif: SAGE Publications.

Lee, C., Mowry, J., Maycock, S. E., Colaianne-Wolfer, M. E., Knight, S. W., & Wyse, D. M. (2019). The impact of hospital-based in situ simulation on nurses' recognition and intervention of patient deterioration. *Journal for Nurses in Professional Development*, *35*(1), 18-24. DOI: 10.1097/NND.0000000000000507.

Lee, M. N., Kang, K. A., Park, S. J., & Kim, S. J. (2017). Effects of pre-education combined with a simulation for caring for children with croup on senior nursing students. *Nursing and Health Sciences, 19*, 264-272. doi: 10.1111/nhs.12340.

Leighton, K. L. (2007). *Learning needs in the traditional clinical environment and the simulated clinical environment: A survey of undergraduate nursing students* (Dissertation, University of Nebraska - Lincoln).

Lin, C., Shih, H., & Sher, P. J. (2007). Integrating technology readiness into technology acceptance: The TRAM Model. *Psychology & Marketing*, *24*(7), 641-657.

Lipman, S.S., Carvalho, B., Cohen, S.E., Druzin, M.L., & Daniels, K. (2013). Response times for emergency cesarean delivery: use of simulation drills to assess and improve obstetric team performance. *Journal of Perinatology, 33*, 259-263.

Lopreiato, J.O. (Ed.), Downing, D., Gammon, W., Lioce, L., Sittner, B., Slot, V., Spain, A.E. (Associate Eds.), and the Terminology & Concepts working Group. (2016). *Healthcare Simulation Dictionary.* Retrieved from http://www.ssih.org/dictionary.

Lucas, A.N. (2008, June). Promoting continuing competence and confidence in nurses through high-fidelity simulation-based learning. *Journal of Continuing Education in Nursing, 39*(6), 360-365.

Makary, M. A., & Daniel, M. (2016). Medical error-the third leading cause of death in the US. *British Medical Journal (Online), 353.* Doi: http://dx.doi.org.contentproxy.phoenix.edu/10.1136/bmj.i2139.

Mehler, D. M. A., Edelsbrunner, P. A. & Matić, K. (2019). Appreciating the significance of non-significant findings in psychology. *Journal of European Psychology Students, 10*(4), pp.1–7. DOI: http://doi.org/10.5334/e2019a.

Moser, B. K. & Stevens, G. R. (1992). Homogeneity of variance in the two-sample means test. *The American Statistician, 46*(1), 19-21. DOI: 10.2307/2684403.

Murray, B., Judge, D., Morris, T., & Opsahl, A. (2019). Interprofessional education: A disaster response simulation activity for military medics, nursing, and paramedic science students. *Nurse Education in Practice, 39*, 67-72. https://doi.org/10.1016/j.nepr.2019.08.004.

Nehring, W. M., Wexler, T., Hughes, F., & Greenwell, A. (2013). Faculty development for the use of high-fidelity patient simulation: A systematic review. *International Journal of Health Sciences Education, 1*(1).

Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic analysis: Striving to meet the trustworthiness criteria. *International Journal of Qualitative Methods, 16*, 1-13. DOI: 10.1177/1609406917733847.

Odlum, M. (2016). Technology readiness of early career nurse trainees: Utilization of the Technology Readiness Index (TRI). *Nursing Informatics*, 314-318. doi:10.3233/978-1-61499-658-3-314.

Parasuraman, A. (2000). Technology readiness index (TRI): A multiple-item scale to measure readiness to embrace new technologies. *Journal of Service Research, 2*(4), 307-320.

Parasuraman, A. & Colby, C.L. (2015). An updated and streamlined technology readiness index: TRI 2.0. *Journal of Service Research, 18*(1), 59-74. Doi: 10.1177/1094670514539730.

Parasuraman, A. & Colby, C.L. (2001). *Techno-ready marketing: How and why your customers adopt technology*. New York, NY: The Free Press.

Partin, J.L., Payne, T.A., & Slemmons, M.F. (2011). Students' perceptions of their learning experiences using high-fidelity simulation to teach concepts relative to obstetrics. *Nursing Education Perspectives, 32*(3), 186-188.

Patterson, M. D., Geis, G. L., Falcone, R. A., LeMaster, T., & Wears, R. L. (2013). In situ simulation: Detection of safety threats and teamwork training in a high risk emergency department. *British Medical Journal of Quality and Safety, 22*, 468-477. Doi: 10.1136/bmjqs-2012-000942.

Petersen, M.J. (2008). *Faculty readiness factors affecting utilization of clinical simulation in nursing education* (Doctoral dissertation). Retrieved from ProQuest. UMI: 3315142.

Reinhart, R.J. (2020, January 6). *Nurses continue to rate highest in honesty, ethics.* Retrieved from Gallup’s News website: https://news.gallup.com.

Riley, W., Davis, S., Miller, K., Hansen, H., Sainfort, F., & Sweet, R. (2011). Didactic and simulation nontechnical skills team training to improve perinatal patient outcomes in a community hospital. *Joint Commission Journal on Quality and Patient Safety, 37*, 357–364. DOI: 10.1016/s1553-7250(11)37046-8.

Riley, W., Begun, J. W., Meredith, L., Miller, K. K., Connolly, K., Price, R. et al. (2016). Integrated approach to reduce perinatal adverse events: standardized processes, interdisciplinary teamwork training, and performance feedback. *Health Services Research*, *51*, 2431–2452. doi: 10.1111/1475-6773.12592.

Risser, D.T., Rice, M.M., Salisbury, M.L., Simon, R., Jay, G.D., & Berns, S.D. (1999). The potential for improved teamwork to reduce medical errors in the emergency department. The MedTeams Research Consortium. *Annals of Emergency Medicine*, *34*(3), 373-383.

Rockbridge Associates. (2014, August 26). Technology Readiness Index primer. https://rockresearch.com/technology-readiness-index-primer/.

Rogers, E. M. (2003). *Diffusion of innovations, 5th edition*. New York: Free Press.

Rosen, M. A., Hunt, E. A., Pronovost, P. J., Federowicz, M. A. & Weaver, S. J. (2012). In Situ simulation in continuing education for the health care professions: A systematic review. *Journal of Continuing Education in the Health Professions, 32*(4), 243-254.

Rossler, K. L., Hardin, K., Hernandez-Leveille, M., & Wright, K. (2018). Newly licensed nurses' perceptions on transitioning into hospital practice with simulation-based education. Nurse Education in Practice, 33, 154-158. https://doi.org/10.1016/j.nepr.2018.10.004.

Russell, K., Brown, J., Manella, L., Colquitt, J., & Ingram, D. (2020). Interprofessional education: TeamSTEPPS® and simulation with respiratory therapy and nursing students in their final year. *Nursing Education Perspectives, 41*(5), 294-296. doi: 10.1097/01.NEP.0000000000000717.

Savery, J. R. (2002). Faculty and student perceptions of technology integration in teaching. *The Journal of Interactive Online Learning, 1*(2), 1-16.

Senger, B., Stapleton, L., & Gorski, M. S. (2012). A hospital and university partnership model for simulation education. Clinical Simulation in Nursing, 8(9), e477-e482. https://doi.org/10.1016/j.ecns.2011.09.002.

Seybert, L. A. & Kane-Gill, S. L. (2011). Elective course in acute care using online learning and patient simulation. *American Journal of Pharmaceutical Education, 75*(3).

Shrestha, R., Shrestha, A. P., Shrestha, S. K., Basnet, S., & Pradhan, A. (2019). Interdisciplinary in situ simulation-based medical education in the emergency department of a teaching hospital in Nepal. *International Journal of Emergency Medicine, 12*. https://doi.org/10.1186/s12245-019-0235-x.

Simon, M. K. & Goes, J. (2013). *Dissertation and scholarly research: recipes for success.* Seattle, WA: Dissertation Success LLC.

Soccio, D. A. (2017). Effectiveness of mental health simulation in replacing traditional clinical hours in baccalaureate nursing education. *Journal of Psychosocial Nursing, 55*(11), 36-43.

Society for Simulation in Healthcare (SSH). (2020). About SSH. Retrieved March 24, 2020 from SSH website: https://www.ssih.org/.

Sodhi, K., Singla, M. K., & Shrivastava, A. (2015). Institutional resuscitation protocols: do they affect cardiopulmonary resuscitation outcomes? A 6-year study in a single tertiary-care centre. *Journal of Anesthesia, 29,* 87–95. doi: 10.1007/s00540-014-1873-z.

Starkweather, A. R. & Kardong-Edgren, S. (2008). Diffusion of innovation: Embedding simulation into nursing curricula. *International Journal of Nursing Education Scholarship, 5*(1). DOI: http://www.bepress.com/ijnes/vol5/iss1/art13.

Steadman, R. H., Coates, W. C., Huang, Y. M., Matevosian, R., Larmon, B. R., McCullough, L., & Ariel, D. (2006). Simulation-based training is superior to problem-based learning for the acquisition of critical assessment and management skills. *Critical Care Medicine, 34*(1), 151-157. Doi: 10.1097/01.CCM.0000190619.42013.94.

Steinemann, S., Berg, B., Skinner, A., DiTulio, A., Anzelon, K., Terada, K, et al. (2011). In situ, multidisciplinary, simulation-based teamwork training improves early trauma care. *Journal of Surgical Education, 68*, 472–477. DOI: 10.1016/j.jsurg.2011.05.009.

Strachan, A.N., Graham, A.C., Hormis, A.P., & Hilton, G. (2011, July). What were the perceptions of primary care teams on learning from a single multidisciplinary simulation-based training intervention? *Education for Primary Care, 22*(4), 229-34.

Strauss, A., & Corbin, J. (1998). *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory.* Thousand Oaks, CA: Sage Publications, Inc.

Taber, K. S. (2018). The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in Science Education, 48*(6), 1273-1296.

Tamaki, T., Inumaru, A., Yokio, Y., Fujii M., Tomita, M., Inoue, Y., Kido, M. et al. (2019). The effectiveness of end-of-life care simulation in undergraduate nursing education: A randomized controlled trial. *Nurse Education Today, 76*, 1-7. https://doi.org/10.1016/j.nedt.2019.01.005.

Theilen, U., Fraser, L., Jones, P., Leonard, P., & Simpson, D. (2017). Regular in-situ simulation training of paediatric Medical Emergency Team leads to sustained improvements in hospital response to deteriorating patients, improved outcomes in intensive care and financial savings. *Resuscitation, 115*, 61–67. doi: 10.1016/j.resuscitation.2017.03.031.

Thomas, C. M., & Kellgren, M. (2017). Benner's Novice to Expert Model: An application for simulation facilitators. *Nursing Science Quarterly, 30*(3), 227–234. https://doi.org/10.1177/0894318417708410.

TIGER Informatics Competencies Collaborative (TICC). (2009, August). TIGER Informatics Competencies Collaborative (TICC) Final Report. Retrieved from https://tigercompetencies.pbworks.com/f/TICC_Final.pdf.

Traynor, M., Gallagher, A., Martin, L., & Smyth, S. (2010). From novice to expert: using simulators to enhance practical skill. *British Journal of Nursing, 19*(22), 1422-1426.

van Schaik, S. M., Plant, J., Diane, S., Tsang, L., & O'Sullivan, P. (2011). Interprofessional team training in pediatric resuscitation: a low-cost, in situ simulation program that enhances self-efficacy among participants. *Clinical Pediatrics*, *50*(9), 807-815. Doi: 10.1177/0009922811405518.

Wehbe-Janek, H., Pliego, J., Sheather, S. & Villamaria, F. (2014, June). System-based interprofessional simulation-based training program of rapid response teams. *The Joint Commission Journal on Quality and Patient Safety*, *40*(6), 279-287.

Zayim, N. & Ozel, D. (2015). Factors affecting nursing students' readiness and perceptions toward the use of mobile technologies for learning. *CIN: Computers, Informatics, Nursing*, *33*(10), 456-464. DOI: 10.1097/CIN.0000000000000172.

APPENDIX A

SURVEY INVITATION

Social Media/Discussion Board Post

Hi! My name is Kristen Wessel from the University of Nebraska-Lincoln. I am conducting a research study on technology readiness of hospital based nurse educators and am seeking volunteers to complete a brief internet survey. Participation will take approximately 10-20 minutes. If you are a licensed RN and educator employed in the hospital setting and are interested, please Click here to complete the online consent & survey or copy and paste this URL: https://unlcba.az1.qualtrics.com/jfe/form/SV_1UkW80jVsvHOCm9. There are no known risks involved in this research and no compensation will be provided.

If you have any questions, please contact me, Kristen Wessel, Principle Investigator, at 402.957.1683, kristen.wessel96@huskers.unl.edu.

Recruitment Email/Letter

Hello [Name]!

I am conducting a research study on technology readiness of hospital based nurse educators and am seeking volunteers to complete a brief internet survey. Participation will take approximately 10-20 minutes. If you are a licensed RN and educator employed in the hospital setting and are interested, please click here to complete the online consent & survey or copy and paste this URL: https://unlcba.az1.qualtrics.com/jfe/form/SV_1UkW80jVsvHOCm9. There are no known risks involved in this research and no compensation will be provided.

If you have any questions, please contact me, Kristen Wessel at Kristen.wessel96@huskers.unl.edu.

Thank you,

Kristen Wessel, PhD-candidate
Principle Investigator
402.957.1683
kristen.wessel96@huskers.unl.edu

Allen Steckelberg, PhD
Associate Professor & Secondary Investigator
402.472.5491
asteckelberg1@unl.edu

Reminder email message

This is a reminder that on [date] we sent you a survey link via email. The survey will be available for you to complete until [date survey is no longer available]. If you have already completed the survey, we thank you for your time. If you have not completed the survey, we would greatly appreciate any input you could provide. Please click here to complete the online consent & survey or copy and paste this URL: https://unlcba.az1.qualtrics.com/jfe/form/SV_1UkW80jVsvHOCm9.

If you have any questions, you may contact me, Kristen Wessel, at Kristen.wessel96@huskers.unl.edu.

Thank you,

Kristen Wessel, PhD-candidate
Principle Investigator
402.957.1683
kristen.wessel96@huskers.unl.edu

Allen Steckelberg, PhD
Associate Professor & Secondary Investigator
402.472.5491
asteckelberg1@unl.edu

APPENDIX B

ONLINE CONSENT & SURVEY

Technology Readiness of HBNEs

Start of Block: Participant Consent

Participant Informed Consent Form
THE UNIVERSITY OF NEBRASKA - LINCOLN
Institutional Review Board # 20200520329EX
Approval Date: 05/01/2020

Title:
HOSPITAL-BASED NURSE EDUCATORS TECHNOLOGY READINESS AND USE OF HIGH-FIDELITY SIMULATION: A QUANTITATIVE STUDY

Purpose:
This research project will aim to study differences in technology readiness among hospital-based nurse educators that use high-fidelity simulation and those that do not. You are invited to participate in this study because you are a Registered Nurse and hospital-based nurse educator.

Procedures:
You will be asked to complete an online survey that will take 10-20 minutes of your time.

Benefits:
There are no direct benefits to you as a research participant.

Risks and/or Discomforts:
There are no known risks or discomforts associated with this research.

Confidentiality:
No personal identifiers will be collected through the survey; only your ISP will be associated with your response. The data will be stored in a password protected site and will only be seen by the investigator during the study and for seven (7) years after the study is complete. De-identified data may be shared, as needed, in order to meet future publications requirements and/or collaborations. The information obtained in this study may be published in scientific journals or presented at scientific meetings, but as either aggregate data or de-identified quotes or comment summary.

Compensation:
You will receive no compensation for participating in this project.

Opportunity to Ask Questions:
You may ask any questions concerning this research and have those questions answered before agreeing to participate in or during the study. Or you may contact the investigator(s) at the phone numbers below. Please contact the University of Nebraska-Lincoln Institutional Review Board at (402) 472-6965 to voice concerns about the research or if you have any questions about your rights as a research participant.

Freedom to Withdraw:
Participation in this study is voluntary. You can refuse to participate or withdraw at any time without harming your relationship with the researchers or the University of Nebraska-Lincoln, or in any other way receive a penalty or loss of benefits to which you are otherwise entitled.

Consent, Right to Receive a Copy:
You are voluntarily making a decision whether or not to participate in this research study. Your signature certifies that you have decided to participate having read and understood the information presented. You may request a copy of this consent form to keep by contacting the Principal Investigator.

Participant Feedback Survey:
The University of Nebraska-Lincoln wants to know about your research experience. This 14 question, multiple-choice survey is anonymous; however, you can provide your contact information if you want someone to follow-up with you. This survey should be completed after your participation in this research. Please complete this optional online survey at: https://ssp.qualtrics.com/SE/?SID=SV_aVvlNCf0U1vse5n.

Name and Phone Number of Investigator(s)

Kristen Bryan Wessel, PhD-candidate, MSN, RN, CNE
Principal Investigator
402.957.1683
kristen.wessel96@huskers.unl.edu

Allen Steckelberg, Ph-D, Associate Professor
Secondary Investigator
402.472.5491
asteckelberg1@unl.edu

Consent of Participant:

You are voluntarily making a decision whether or not to participate in this research study. By completing and submitting your survey responses, you will be giving your consent to participate in this research. You should print a copy of this page for your records.

- I consent to participate in this research study. (1)
- I do not consent to participate in this research study. (2)

End of Block: Participant Consent

Q1 Are you a registered nurse?

- Yes (1)
- No (3)

Q2 Are you employed in a role as a staff educator or professional development specialist within an acute care setting (ie: hospital or medical center)?

- Yes (1)
- No (2)

Q3 Please enter the total number of years of experience that you hold as a Registered Nurse.

____

Q4 Please identify the highest level of education you have completed.

- Associate Degree (1)
- Baccalaureate Degree (2)
- Master's Degree (3)
- Doctorate (4)

Q5 Gender

- Male (1)
- Female (2)

Q6 Age

____

Q7 Please enter the number of years of experience you hold as a nurse educator/professional development specialist.

____

Q8 Please enter your current job title.

____

Q9 Please describe your primary responsibilities.

____

Q10 Please enter the state in which you work

____

Q11 Please select the region that most describes the location of the hospital in which you work

- Rural
- Urban

Q12 Please select the type of hospital in which you work (select all that apply)

- Academic
- Non-academic
- For-Profit
- Not-For-Profit

Q13 Do you utilize high fidelity simulation in your educator practice?
For the purpose of this study, the definition of high fidelity simulation will be limited to a simulated patient care experience during which the hospital staff experience a high level of interactivity (such as in situ, i.e. in the patient care environment, and/or designated lab space resembling the patient care environment) and realism using a high-fidelity manikin simulator (such as SimMan 3G, SimNewB, HAL, NOELLE, Premie HAL, etc.)

- Yes (1)
- No (2)

Q14 Would you like to learn how to integrate high fidelity simulation in the education/training that you implement?

- Yes (1)
- No (2)

Q15 What factors have prevented you from integrating high fidelity simulation?

1. Access - "The equipment and/or space is not available to me." (1)
2. Cost - "My organization does not have funds to support high fidelity simulation." (2)
3. Personal knowledge/skill - "I don't have enough information or training." (3)
4. Lack of administrator support - "The organization's administrator(s) don't feel the investment is necessary." (4)
5. Personal value - "I don't see the value in simulation. There are other effective strategies." (6)
6. other - please specify (5) ____

Q16 Why have you chosen to integrate high fidelity simulation in the education/training of healthcare professionals in your organization?

____

Q17 What education and/or training have you received to support implementation of high fidelity simulation?

____

We are interested in your views on how technology influences your life and your nursing education practice. These questions comprise the Technology Readiness Index 2.0 which is copyrighted by A. Parasuraman and Rockbridge Associates, Inc., 2014. This scale may be duplicated only with written permission from the authors.

Please indicate how much you agree with the following statements.

Q18 New technologies contribute to a better quality of life.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neutral (3)
- Somewhat agree (4)
- Strongly agree (5)

Q19 Technology gives me more freedom of mobility.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neutral (3)
- Somewhat agree (4)
- Strongly agree (5)

Q20 Technology gives people more control over their daily lives.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neutral (3)
- Somewhat agree (4)
- Strongly agree (5)

Q21 Technology makes me more productive in my personal life.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neutral (3)
- Somewhat agree (4)
- Strongly agree (5)

Q22 Other people come to me for advice on new technologies.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neutral (3)
- Somewhat agree (4)
- Strongly agree (5)

Q23 In general, I am among the first in my circle of friends to acquire new technology when it appears.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neutral (3)
- Somewhat agree (4)
- Strongly agree (5)

Q24 I can usually figure out new high-tech products and services without help from others.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neutral (3)
- Somewhat agree (4)
- Strongly agree (5)

Q25 I keep up with the latest technological developments in my areas of interest.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neutral (3)
- Somewhat agree (4)
- Strongly agree (5)

Q26 When I get technical support from a provider of a high-tech product or service, I sometimes feel as if I am being taken advantage of by someone who knows more than I do.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neutral (3)
- Somewhat agree (4)
- Strongly agree (5)

Q27 Technical support lines are not helpful because they don't explain things in terms I understand.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neutral (3)
- Somewhat agree (4)
- Strongly agree (5)

Q28 Sometimes, I think that technology systems are not designed for use by ordinary people.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neutral (3)
- Somewhat agree (4)
- Strongly agree (5)

Q28 There is no such thing as a manual for a high-tech product or service that's written in plain language.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neutral (3)
- Somewhat agree (4)
- Strongly agree (5)

Q29 People are too dependent on technology to do things for them.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neutral (3)
- Somewhat agree (4)
- Strongly agree (5)

Q30 Too much technology distracts people to a point that is harmful.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neutral (3)
- Somewhat agree (4)
- Strongly agree (5)

Q31 Technology lowers the quality of relationships by reducing personal interaction.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neutral (3)
- Somewhat agree (4)
- Strongly agree (5)

Q32 I do not feel confident doing business with a place that can only be reached online.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neutral (3)
- Somewhat agree (4)
- Strongly agree (5)

Q33 Please feel free to share any additional comments or thoughts.

____

Thank you for your participation and contribution to this study!

If you have any questions or concerns, please contact:

Kristen Bryan Wessel
Graduate Student & Principal Investigator
kristen.wessel96@huskers.unl.edu

Allen Steckelberg, Ph-D, Associate Professor
Secondary Investigator
402.472.5491
asteckelberg1@unl.edu

APPENDIX C

CC

Charles Colby <ccolby@rockresearch.com>

Wed 9/26/2018 1:08 PM

To: Kristen Wessel

Cc: Parasuraman, A <aparasur@bus.miami.edu>; Kristen Wessel; Rock Info <rockinfo@rockresearch.com>

Reply all

Inbox

Flag for follow up. Completed on Sunday, October 21, 2018.

TR Index 2.0 List for Aca...
32 KB

Show all 1 attachments (32 KB) Download Save to OneDrive - University of Nebraska-Lincoln

Hello Kristen,

The paperwork is in good shape. You now have a license to use the TRI 2.0 for your scholarly research. To assist you, I am attaching a list of scale items and recommendations on administration.

Good luck with your study.

Regards,

ROCKBRIDGE

Charles L. Colby
Principal, Chief Methodologist and Founder
Office: 703 757 5213 ext. 12
10130 G Colvin Run Road, Great Falls, VA 22066
www.rockresearch.com | ccolby@rockresearch.com