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High Fidelity Simulation: Panacea or Potential Problem?

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HIGH FIDELITY SIMULATION: PANACEA OR POTENTIAL PROBLEM?

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Abstract

An expanding trend in health science education is to replace time spent in traditional clinical settings with high fidelity simulation (HFS). Utilizing a ethnographic methodology to observe students as they engaged in HFS and exploratory interviews to uncover student perceptions, this qualitative work sought to further understand the implications of this trend by exploring what students experienced when they interacted with HFS mannequins in simulated environments. Twenty five students attending a large Ontario community college participated in the twenty two HFS scenarios that were evaluated in this study. While the numerous benefits of HFS identified in the literature were also evident in this work, the results emerging from this study suggested that students do not perceive HFS as they do real life. The implications of this perception on the trend to replace time in clinical learning environments with HFS are presented in the discussion.

Keywords

High fidelity simulation, health science education, mannequin, grounded theory, clinical education.

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Preface: Locating myself in the work

This thesis employs an ethnographic approach to explore the *what* and *why* questions emerging from the use of high fidelity simulation in the education of health science students. As I inserted myself into this work it is arguably necessary that you, the reader, be exposed to not only my research but also to the significant experiences that have impacted me and, as a result, shaped the various lenses through which I will be viewing this work.

The clock arm swings past 0300 hrs. on a busy night in the intensive care unit (ICU) where I am working as a young critical care RN in a large teaching hospital. I am holding the hand of a young wife, "Susan" as I begin to initiate what is known as "withdrawal of treatment" on her 35 year old husband, "Bob". With her other hand, Susan is clutching their school aged daughter to her side. Tears are just below the surface as I look through rapidly blinking eyes and recall that a previously healthy Bob had presented earlier in the week with chest pain and shortness of breath which was attributed to an inflammation of the anatomical sac which surrounds the heart. This was not supposed to have gone like this. Bob's condition, known as pericarditis, typically responds well to treatment and patients' are expected to move on to a full recovery. Tragically for Bob and his family, that did not happen as all efforts to resolve his condition were unsuccessful and he subsequently developed multi-system organ failure with no chance of recovery. I continued my futile attempts to keep my tears below the surface as his daughter crawls up beside her dad and says her final goodbyes before being taken out of the unit by her grandparents. As I look over his comatose body, the rational side of my consciousness processes that all of Bob's major organ systems have shut down, his brain is not functioning and if it were not for the application of complex invasive technology, commonly referred to as "life support", he would have died days ago. Although Bob is now unconscious and non-responsive, I ensure he has an adequate amount of narcotics on board to control any pain he might be experiencing while I re-affirm with Susan that she understands what she has consented to, what we going to do and what she can expect to happen. Working with the respiratory therapist we remove Bob's breathing tube, ensure his airway is clear and then begin to reduce the amount of medication he is receiving to let the natural course of death occur. Susan pulls up a chair and sits beside Bob's bed and I sense that she wants to talk. I listen. We share a comfortable silence as together we watch Bob's breathing becoming more irregular. I pull the curtains and provide what privacy I can so that she can have some final alone time with him. His vital signs cease at 0730 hours and his wife tearfully embraces me as Bob is declared dead.

This event occurred over two decades ago. Despite the significant passage of time, it provides context for this work and is presented to provide insight as to why I chose to explore the issues that are emerging as the academy of health science education continues to expand the practice of replacing clinical experience (educational opportunities in which student practitioners interact with actual human patients in actual clinical settings) with opportunities for students to engage with computer controlled mannequins in a simulated environment. Interacting with patients is a human experience. It is difficult and challenging work. My experiences as a critical care practitioner make me question if this complex skill can be sufficiently developed by interacting with a microprocessor.

The critical tone of the statement above may cause the reader to believe that this an anti-technology work. Far from it, I like to work with my hands and I am very comfortable with tools and technology. In hindsight, these personal characteristics undoubtedly played a large role in my decision to initially pursue a career in the technology rich environment of intensive care. However, despite finding some initial comfort with the pumps, alarms and gadgets that fill the ICU, I quickly realized that the challenge was not working with the technology, the real work for me was being the warm, caring body that effectively engaged with the patients or, as the story above illustrates, their families.

This preface is not to be misinterpreted as a narcissistic preamble to a *pity party*. I enjoyed my work in the ICU. Yes, it was at times emotionally draining. Walking step by step with a family as their loved one moves progressively and inextricably closer to death is an emotionally exhausting experience. Yet, as I reflected on those fatiguing interactions, I realized that I also found them rewarding. I began to appreciate that my role as a Registered Nurse was not what I thought it would be when the naivety and inexperience of youth and caused me to believe I was going to save the world. My role was also, (and perhaps arguably, more so in the critical care environment), to provide my patients and their families with support and often that would include support throughout a death experience. This expansion in my understanding of what I perceived to be my purpose as a care provider was not an overnight journey. The transition took time, consultation with colleagues, spiritual advisors and feedback from patients and their families to help me appreciate that my notion of what “saving the world” looked like as an RN was far broader than I ever had imagined. It was not about making people well, it was about engaging with individuals in a manner that made them feel valued and respected as they made their journey through the health care system.

My understanding of the need for care providers to engage effectively with patients was also shaped by my experiences as a patient who had suffered a critical injury. During nursing school I was pulled from a horse drawn sleigh while we were celebrating the first day of what was euphemistically known as reading week. I hit the frozen ground hard, head first and was alarmed at the loud crunching sound that was generated on impact. As I carefully turned my head I heard what I best describe as the sound of corn popping emitting from my neck. I took my gloves off, wiggled my fingers and felt a wave of relief as I affirmed I could still move. But I knew something was seriously wrong and went to the local emergency room (ER). In the ER examining room I looked OK, had minimal numbness or tingling, I could walk without any issues and all of my reflexes were intact. I explained my concerns, what I heard when I landed and what I felt, but no one listened. Disregarded, I felt like a "cold body" that was just there to be processed and dismissed as the machine of ER efficiency hummed along (DeLuca, Bethune-Davis, Elliot, 2015). The physician told me to go home. Fortunately, I listened to my inner voice, became noncompliant and refused to leave without an x-ray. I am unsure if it was the inability to engage in a discourse or if they just feared "a scene", regardless, I was placated and sent, notably without any cervical spine precautions in place, for the x-ray I demanded. The machine like "going through the motions" approach to my care suddenly came to a screeching halt as the first film emerged from the processor and came into view for the technician. My neck was smashed and unstable. Cervical vertebrae 5 was crushed into what is referred to as a wedge fracture and it was evident that any movement on my part could result in serious spinal cord damage. Fortunately, after a prolonged period in cervical traction and extensive surgery I went on to a full recovery. However, I am frightened when I ponder the likely outcome (quadriplegia, inability to have children) if I had not listened to my inner voice and forced those that were entrusted to "care" for me to listen to my concerns.

The intensive care unit in which I was employed had a significant education program to provide new nurses to the area with the unique knowledge and skills they required to work in this highly specialized environment. I was asked to work with new staff in this program and a light went on as I discovered that while I enjoyed being a clinician, I really got excited when I could help someone else discover the passion for providing front line care. I also uncovered something else. The common understanding was that learning the specialized drugs, equipment and procedures associated with critical care was the difficult aspect of the training. This was inconsistent with my experience facilitating the progress of new critical care practitioners as I began to appreciate that for most, developing competency with clinical skills came relatively easily. A significantly greater challenge however, was to develop the ability to successfully interact in the complex communication milieu that accompanies the critically ill patient.

Inspired by a desire to teach, I left the ICU to become a college educator of health science students. Although my college educational career began in Nursing, I soon moved to emergency care and have been primarily focused on Paramedic education for the bulk of my career in postsecondary education. Again my passion for technology emerged, and I became the early adopter and workshop facilitator to explore ways in which we could utilize technology as a means to enrich the student learning experience. Watching my inspired colleagues at work I witnessed firsthand that there are few limits to what can be accomplished when powerful technology is embraced by creative educators. I was privileged to work with a passionate team that embraced the use of computer controlled mannequins, used “Hollywood quality” makeup to mimic the appearance of real life traumatic injuries and developed nationally recognized, large scale simulations involving hundreds of participants in massive interdisciplinary disaster response exercises. Yet despite these endeavors, the most common complaint from employers of our new graduates remained relatively unchanged from my observations of ICU nurse candidates years ago: that new practitioners continue to have difficulty interacting effectively with patients.

With insight that seems to emerge with extended experience, I increasingly find myself struggling with an educational dilemma. On the one hand I hold a fundamental belief in the ability of technology to enhance student learning, while on the other, my lived experience as a critical care RN, a seriously injured patient and a long time educator cause me to question the ability of simulation technology to develop the capacity for the human interaction that lies at the heart of patient care.

Chapter 1

1 Introduction: Asking the Questions

1.1 The Issue

Traditionally, health science programs have required students to complete significant amounts of time in clinical settings with actual patients as they develop their ability to deliver health care. A health professional student would typically spend more time in "clinical" than any other learning environment within a program. The traditional educational approach is increasingly more difficult to provide to health science students, as escalating demands on these clinical areas has resulted in reduced access for students (Grant & Davis, 2004; Issenberg, Mcgaghie, Petrusa, Gordon, & Scalese, 2005; Macedonia, Gherman, & Satin, 2003; Maran & Galvin, 2003; Reilly & Spratt, 2007; Waldner & Olson, 2007). As a consequence, health profession educators are required to condense the amount of time a student would spend in a traditional clinical setting and replace these experiences with increased time spent in new, technologically advanced, simulation areas (C. Reed, personal communication, September 29, 2008; DeLuca, Bethune-Davis, Elliot, 2015; Florida Board of Nursing, 2007; Gassert, 2006; Nehring, 2008; Hayden, 2014). As an educator of health science students my experience with the introduction of technology into health science education is consistent with what I have found expressed in the literature. Technology has appreciably enhanced the teaching and learning process in simulated environments and represents a significant improvement over previously utilized “low tech” options (e.g. learning intramuscular injections by injecting an orange), (Kneebone, 2003; Maran & Galvin, 2003). While the benefits of technology in the didactic component of health science education are widely identified and acknowledged, minimal work has been completed to support the effectiveness of educating health care professionals by replacing human patient interactions with time spent in contact with microprocessor driven mannequins (Laschinger et al., 2008).

1.2 Background to the Questions

The practice of simulating real life experiences is an educational approach that can be traced back to the "writings of Aristotle and the practices of Socrates" (Ruben, 1999, p. 500). Advances in computer technology however, have dramatically affected the nature, scope and appearance of simulation. To illustrate the effect that technology has had on simulation consider that in the 1970's a person playing the newly released video game of that period was entertained (as evidenced by the popularity of the game) by moving a white bar shaped "paddle" across a black screen to "hit" a white, square "ball" (Winter, 2001). Despite the enjoyment the novel game provided, the limited nature of the interaction did not allow the player to feel any of the sensations that one would experience while actually playing ping pong. Today however, observe a group of seniors "bowling" using a high definition, surround sound, interactive gaming system and it becomes more difficult to make the same claim. Technology in the hands of creative thinkers has allowed simulation experiences to become increasingly closer to the reality that they were intended to represent. But can simulation replace reality?

The term fidelity is employed to describe the extent to which a simulation matches the appearance and behaviour of the reality it is endeavoring to emulate (Farmer, van Rooij, Riemersma, Joma, & Moral 1999). The use of technologically advanced, computer programmed, anatomically correct mannequins complete with palpable pulses, breath sounds, blood pressure, voice, breathing mechanics, and heart rhythms that allow for complex physiological responses in environments designed to replicate clinical settings is known as high fidelity simulation (HFS) (McCaughey, 2010; Small, et al., 1999,). Although these learning environments may look like a hospital room and the "patient" on the bed has computer enabled, life-like attributes that facilitates cognitive development and the acquisition of skills, are these simulations of sufficient fidelity that learning experienced by health science students in a clinical setting with actual patients can be replicated in a simulated environment using HFS?

Like countless others, I have been drawn into the enticing web of HFS. The high fidelity medium provides a platform that fosters limitless creativity, dramatically expands our ability to provide experiential learning and actively engages students in their learning. In other words, HFS is “cool”. However, my experience as both a clinician delivering front line patient care and as educator facilitating health science students’ transition from neophyte to competent practitioner provides me with the insight to appreciate that the real challenge in becoming an independent care provider is not the ability to perform a psychomotor task, prioritize actions or even implement effective clinical judgment, rather it is the capacity to provide the human element in the patient’s experience. As Carl Buehner succinctly articulated decades ago “They may forget what you said – but they will never forget how you made them feel” (O’Toole, 2014). This criticality of the human element in the patient interaction is also supported by Griffin et al. (2004) who concluded that, “successful interactions between patients and their practitioners lie at the heart of medicine” (p. 595). Despite many positive, well documented attributes, does HFS create an environment that allows participants to have a human experience? Or, does the academy’s ever expanding use of silicone covered, high fidelity mannequins further contribute to conceptualization of the patient as ‘thing’ to be fixed or a ‘cold body’ (DeLuca, et al., 2015)?

Simulation has quickly become a popular research subject (McGaghie, 2010), as educators question the ability of HFS to effect numerous aspects of health care including, but certainly not limited to: skill development, competence, confidence, learner satisfaction, skill transfer, end of life care, disaster response, patient safety, research, etc. (Issenberg, 2005; Knudson, 2013; Kopp & Hanson, 2012; Morrison & Catanzaro, 2010; Reilly & Spratt, 2007) however, a review of this work reveals a surprising paucity of evidence that questions what is actually happening when students engage with high fidelity mannequins that are being utilized to simulate human patients. In juxtaposition to DeLuca’s notion of the “cold body” do students engage with the mannequin as if it was a “warm body”? Specifically, do students: talk with mannequins? touch the mannequins? make eye contact with the mannequins? demonstrate emotion in these scenarios? change their demeanor in response to an alteration in the mannequin’s condition? display affect that is consistent with the scenario? In our haste to use our creative educator talents in the exciting medium of HFS have we missed asking the fundamental question of what HSF contributes to the human element of a patient interaction?

1.3 Exploring the Questions

As I continued to expand my own use of HFS in the education of Health Science students and saw others rushing to get on the simulation bandwagon, I began to view HFS through a more critical lens. I was impassioned about the use of HFS but at the same time I was becoming more conflicted as I began to question the efficacy of HFS. As noted above, reviewing the literature revealed a significant volume of work measuring various performance indicators and supporting the use of HFS, but despite the quantity of research investigating HFS it remained under theorized (Schiavenato, 2009) with fundamental questions regarding what HFS could and could not do going unanswered. Although the HFS band wagon was filling up as the obvious course to pursue in health science education, other than work utilizing surveys exploring student's perceptions of HFS, I was challenged to find evidence that addressed the "warm body" questions that kept occupying an ever greater portion of my consciousness.

My need to address the "warm body" elements that are an essential part of providing care (Mead & Bower, 2000) led to the conceptualization of this work. I wanted to explore what students experienced as they engaged in HFS. Rather than adding to the relatively significant body of self-efficacy derived evidence (Leigh, 2008) I saw the need to approach this *what* question from the lenses of ethnography and Ground Theory methodologies. I designed a study that would provide video evidence of health science students in actual HFS scenarios that could then later be analyzed and coded through my lens as an experienced clinician and educator for behavioral trends and themes. After determining *what* was occurring, I conducted subsequent interviews as a means to help explore the *why* questions that I expected to arise as result of the analysis of the students' behavior in their HFS scenarios. Recognizing the need to gather rich data, while at the same time appreciating the limits of time, resources and scope for a Masters' thesis, I involved students from two distinct health science disciplines engaging in 22 HFS scenarios.

1.4 The Research Question

In the current health care education environment of reduced (and in some cases eliminated) access to clinical sites the trend to replace clinical experience with HFS is viewed as necessary and arguably, logical despite the limited amount of research evidence to support the move (Bond et al., 2008; Laschinger et al., 2008; Rauen, 2004). As a key element of clinical practice has been identified as successful interaction between care provider and patient (Griffin et al., 2004) and the current trend in the education of students learning to deliver health care is to replace student health care provider – patient interactions with HFS with few questioning the effect of inserting the “cold body” of a mannequin into a human interaction, the intent of this study is to explore the nature of the interaction between health science students and computer aided mannequins in high fidelity simulations. **What do health science students experience when they interact with high fidelity simulation mannequins in simulated environments?**

1.5 The Journey to Answer the Question

Following the identification of the numerous issues and questions that arise from the ever expanding use of HFS in the education of health science students, the text progresses from the research question to explore the literature dedicated to HFS. The amount of work exploring the various elements of HFS is substantive. As a result, the reader will be presented with a focused literature review in chapter two that explores the elements of HFS that best support and challenge the research question. The literature review then leads the reader to an explanation and justification of the conceptual model which underpins this research.

After a review of the rationale for the utilization of a qualitative, grounded theory methodology the text in chapter three then describes the process utilized to gather the rich data uncovered in this research. Themes emerging from data analysis are then presented analyzed and interpreted in chapter four.

In the final chapter the reader will find my interpretation and limitations of the research findings as well the potential implications of this work on the current practice of utilizing HFS to replace clinical education experiences.

Chapter 2

2 The Literature

Like Seniors playing a modern day video game, health science students are more entertained and engaged in HFS situations than they previously were in traditional labs which were unencumbered by technology (Bradley, 2006; Friedman, 1995). Therein lies the crux of the issue. HFS represents such a significant enhancement to the education of health science students that it is irresistibly attractive to couple expanding technology with the creativity of educators to produce ever more realistic and stimulating environments for students to learn in. So much so, that few have paused to question where the line between simulation and reality lies. Arguably, as technology continues to expand and educators continue to develop their expertise in utilizing it, the line will move, perhaps to the point where it is blurred beyond recognition. However, in light of the current trend to replace real life patient interactions with HFS, the intent of my literature review is to explore where the line might exist today.

In the review of the literature I will first investigate the aspects of patient care that can be learned through the use of simulation by examining the history, successes and failures of HFS simulation across the health science disciplines. In light of the movement in health care provider education to utilize student-mannequin interaction as a substitute for student-patient interaction, I will then explore the literature to identify elements of the health provider-patient interaction and the health provider – mannequin interaction. In doing so I intend to identify any gaps into which this work, exploring the nature of the student – HFS simulation mannequin interaction, will be positioned.

2.1 Examination of High Fidelity Simulation

2.1.1 HFS: The history

As previously noted, simulating real life events with games, role play and application of the technology of the day with the intent to enhance one's ability to perform in the actual event is a common practice that has been occurring for centuries. Macednonia, Gherman and Satin, (2003) maintain that "medical simulation likely predates recorded history" (p.

388) as they describe how our ancient ancestors in the Paleolithic period created leather models of women with the apparent intention of simulating child birth. Today my nephews enjoy playing (and often beating) their uncle in a stimulating game of chess. What my nephews do not appreciate is we are participating in a war simulation whose origins date back to 600 A.D. (United States Chess Federation, n.d.). Although arguably a less cerebral war simulation, warriors in the Middle Ages utilized advancing technology to create more elaborate simulation and saw jousting emerge as a means to provide knights with “practical, hands-on preparation in horsemanship, accuracy and combat simulations that kept them in fighting shape between battles” (History UK, n.d.). Technological advancements continued to progress through into the 1800’s when the industrial revolution and developments in power, communication and transportation provided the platform for creative educators to continue to develop higher fidelity simulation experiences that more closely imitated real life. Technology and enhanced communication would “forever change the way people relate to each other” (Rosen, 2013 p.5) and laid the foundation for radical changes in the use of simulation across numerous disciplines (Bradley, 2006).

One of the first industries to harness technological advances and seize simulation as medium to enhance the educational process was aviation. At first glance flying an aircraft may appear far removed from HFS and patient care. However, the significant number of HFS authors that reference aviation simulation (Blum, 2012; Bradley, 2006; Cooper, 2004; DeMaria, 2014; Dresser, 2007; Drews & Bakdash, 2013; Fritz, Gray, & Flanagan, 2008; Good, 2003; Gordon, Wilkerson, Shaffer, & Armstrong, 2001; Gore, Hunt, & Raines, 2008; Grenvik & Schaefer, 2004; Harris, Eccles, Ward, & Whyte, 2013; Leigh, 2008; Macedonia, Gherman, & Satin, 2003; Maran & Glavin, 2003; McGarry, 2014; Nehring, 2008; Okuda et al, 2009; Seybert, Laughlin, Benedict, Barton, & Rea, 2006; Rauen, 2004; Rosen, 2008; Small et al, 1999; Waterson, Flanagan, Donovan, & Robinson, 2000; Ziv, Ben-David, & Ziv, 2005) as they describe influences on the development of patient care simulation warrants an inclusion of flight simulation in this review of the literature. Although the references to aviation simulation are numerous in the HFS literature and the prevalence of these references implies that the success of simulation in aviation education can translate into success of HFS in patient care education, absent in the discussion is a comparison of the fundamental and significant differences between the work environment of a pilot and that of a health care provider. Does the use of a computer interface simulation that successfully prepares pilots to interact with a plane indicate that the use of a microprocessor enhanced mannequin can successfully prepare health science students to successfully interact with a patient?

Although simulation has been an education technique utilized for centuries, the development of the microcomputer launched the use of simulation into hyperdrive across a variety of industries including flight training, military exercises, business management and even disaster simulations for nuclear plant operators.

2.1.2 HFS: Acquisition of Psychomotor Skills

The passing of tubes through various body orifices or through the skin is a technical skill that is associated with a degree of risk to the patient if performed incorrectly. Nursing students trained on high fidelity mannequins showed improved performance re-demonstrating the skill sets of nasogastric tube insertion and urinary catheter insertion than those trained on low-tech mannequins (Grady, et al. 2008). Naylor et al. (2009) arrived at a similar conclusion in their investigation of the ability of third year medical students to learn how to perform urinary catheterization using simulation.

Similarly, Hall, et al. (2005) investigated the ability of Paramedic students to acquire the skill set of endotracheal intubation (ETI) using HFS. Randomizing a group of 36 Canadian Paramedic students ½ were trained utilizing traditional operating room time with an anesthetist while the remaining students were trained using HFS. After receiving the training each group then completed 270 ETI’s (15 per student) in a controlled setting within the operating room. The authors concluded that both simulator and operating room training allowed the students to acquire sufficient ETI skills.

2.1.3 HFS: Development of Assessment Skills

Developing the ability to apply knowledge to interpret assessment findings is a more dynamic skill than the tube insertions describe above, however, as Steadman, et al. (2006) argue, HFS may also enhance a student’s ability to interpret assessment findings.

Comparing a traditional method of case study and oral feedback from an instructor, (a process identified by the authors as problem based learning), to HFS, the medical students engaged in HFS scored significantly higher on the final assessment of skill acquisition than did the students who were trained using traditional methods. As a medical specialty, Anesthesia has arguably achieved the most extensive and long standing use of HFS in health care education. After a randomized trail evaluating anesthetists and anesthesia trainees' ability to recognize and respond to malignant hypothermia, Chopra et al. (1994) concluded that "training on an anesthesia simulator does improve the performance of anesthetists in dealing with emergencies during anesthesia" (p. 293).

2.1.4 How is HFS perceived by Health Science Students?

In addition to the research which supports enhanced skill acquisition through the use of HFS, the students experiencing HFS report that they believe it is an effective training modality. In a survey of 28 Emergency Medical Technicians (EMT's) Bier and Hile (2008) concluded that the perception of those using advanced procedure mannequins was superior to traditional models of training. Likewise, nurses participating in a simulation experience designed to enhance the ability of nursing staff in a bone marrow transplant unit to manage critically ill patients also reported a high degree of satisfaction with HFS. All 12 nurses participating in the simulation recommending that HFS be used for subsequent sessions (Kuhrik, N.S., Kuhrik, M. Rimkus, Tecu, & Woodhouse, 2008). Enhancing self-confidence may be one reason that students reflect positively on HFS experiences. Goldenberg, Andrusyszn and Iwasiw (2005) indicate that despite the limitations of a small, (n=22), convenience sample, nursing students participating in HFS report a significant increase in self-efficacy scores after engaging in a HFS experience.

These works indicate that students perceive HFS positively. However in an investigation of student and faculty perceptions of HFS, Feingold, Calaluce and Kallen (2004) raise a question that further serves to position this enquiry. Consistent with the Kuhrik, Kuhrik, Rimkus, Tecu, & Woodhouse (2008) and Goldenberg, Andrusyszn and Iwasiw (2005), Feingold, Calaluce and Kallen (2004) report that the majority of both students and faculty found HFS simulation realistic and valuable. However, when the authors questioned if skills learned in the simulated environment would transfer to actual clinical settings only half (50.8%) of the 65 students surveyed felt that transfer would occur. Interestingly, this response contrasts significantly with the perceptions of the faculty group of which 100% felt that skills developed in simulated environments would transfer to real life experiences. Do the people experiencing the simulation know something that those observing it do not?

2.1.5 HFS: Impact on patient safety

HFS literature indicates that enhanced patient safety may be an additional benefit to be gained by expanding the utilization of simulation. Reflecting on the use of HFS simulation in the orientation of nurses to cardiac surgery, Rauen (2004) identifies that the ability for students to learn in an environment where making mistakes does not result in a threat to patient safety is a distinct advantage to simulation as a teaching strategy. Similarly, Issenberg et al. (1999) report that HFS allows surgical residents the opportunity to develop their laparoscopic skill sets such as hand-eye coordination, cutting technique, suture placement and knot tying all without any risk to a patient.

Identifying patient safety as a priority in nursing care, Gore, Hunt & Raines (2008) implemented a unique experience in which they employed HFS to allow nursing students the opportunity to make mistakes without harming patients. In a mock hospital unit students were required to "work" a four hour shift prior to attending an actual clinical experience. During that time the researchers created situations that compromised patient safety (e.g. medication error),created patient injuries (e.g. moved a mannequin onto the floor to simulate a fall after a student erroneously left a bed rail in a down position) and observed how the students responded. Simulation allowed the authors to create hazards representing a threat to patient safety which allowed the students to apply assessment, critical thinking and evaluation skills as they responded. As the authors note, outcomes were not monitored to determine if this experience resulted in enhanced patient safety, however they do conclude that simulation "is a most effective way to decrease the risk of patient injury" (p. 61).

2.1.6 HFS: Influence on Research

Balancing the requirement to ensure the safety of human subjects with the need to evaluating the effectiveness of new patient care equipment and procedures is oftentimes challenging. Questioning the most effective method to manage an airway in prehospital pediatric arrest, Chen and Hsiao (2008) desired to compare the efficacy of endotracheal intubation (ETI) and the Laryngeal Mask Airway (LMA). HFS was selected as the method utilized to proceed with the trial without creating patient harm. As a result of their study, Chen and Hsiao conclude that, "the LMA led to more rapid establishment of effective ventilation and fewer complications" (p. e297) and support the use of the LMA to manage pediatric patient airways in the out of hospital environment. Although HFS allowed Chen and Hsiao's trial to proceed without risk to children, this trial also illuminates a question that helped shape this current study, that being, is it reasonable to extrapolate findings derived from a simulator to a human population? The authors do not include this issue as a potential limitation to their findings.

2.1.7 HSF Concerns and Critical Questions

As noted from the review of the literature, there is significant support for the use of HFS in the education of health care providers. Research that identifies concerns or raises critical questions surrounding the use HFS is generally not well evidenced in the literatures. This is not intended as a criticism of our research community but is rather, I believe, a reflection of the allure and common sense appeal of HFS. Although expensive (Nehring & Lashley, 2004), it *works*.

So alluring is the potential draw of HFS that Kneebone, Scott, Darzi & Horrocks (2004) caution that there is the "danger that simulation may become an end in itself, disconnected from the professional practice for which it purports to be a preparation" (p. 1099). That said, many authors investigating the use of HFS in health science education note that the effectiveness of the methodology is offset by the increased time required by faculty to engage the technology, design scenario's, maintain equipment, and explore questions of how to re-create life-like situations, such as "does apple juice or ginger ale best simulate urine and which of these will not damage the $50,000 mannequin?" (Goldenberg et al. 2005; Gore et al. 2008).

In one of few works that calls into question the effectiveness of HFS, Engum, Jeffries and Fischer (2003), recruited 163 nursing and medical students to participate in a randomized trial that compared the ability of the students to develop their IV cannulation skills using either a high fidelity, computer IV catheter simulator or, the traditional "low tech" demonstration followed by practice on plastic arms. Both groups had comparable pretest scores and both groups developed similar ability to demonstrate the skill. The results of the study indicated that the group exposed to the traditional "low tech" methodology showed, "a significant improvement in cognitive gains, student satisfaction and documentation of the procedure" (p. 67) when compared to the HFS group. The authors also report that the traditional low tech method was preferred by the students. At first brush the evidence provided by Engum et al. (2003) suggests that the investment in HFS may not produce results that are in any way improved, and in fact may be worse than those afforded by traditional, low tech (and low cost) methods. The value of an alternative position aside, a review of the methodology of this study reveals that the variable between the two groups was not limited to the sophistication of the simulation device. The low tech group was provided an instructor whereas the HFS group was not. It is a reasonable criticism that the results reported by the authors were less influenced by the nature of the simulation device and more significantly affected by the interaction that the students had with another human being (their instructor).

My methodological criticisms aside, the results articulated by Engum et al. (2003) serve to further position this inquiry. In Engum et al.'s work, despite the attractiveness of HFS, a high tech, high cost simulator could not replicate the results produced by traditional interaction between student and instructor. These findings are consistent with social learning theory as developed by Bandura (1977), which argues that the most powerful effect on the student in this situation would not be the lure of the HFS but rather the interaction with their instructor.

My review of the literature indicated that HFS has enhanced health care provider education as HFS has been shown to facilitate acquisition of psychomotor skill sets, enhance development of assessment skills, improve self-efficacy, have a positive impact of patient safety, make trials of new patient care equipment possible, quantify evaluation and is well received by the students. These findings are consistent with the results of a systemic review of HFS conducted by Issenberg, et al. (2005) in which these authors conclude that, “high-fidelity medical simulations are educationally effective and simulation-based education complements medical education” (p. 10). Likewise, Rauen (2004) articulates numerous advantages of HFS, however, despite the significant, positive impact of HFS on health provider education she concludes succinctly, “the research available is not sufficient to support having simulation replace clinical education” (p. 51).

It is into this identified gap that I will position my work. Given the current reality of decreasing access to clinical sites and, regardless of the lack of evidentiary support, the corresponding trend to replace these experiences with HFS, there is a significant need to hold this educational practice up to question. But through what theoretical lens?

2.2 Exploring Health Care Provider – Mannequin Interactions

Numerous authors ascribe lifelike attributes to HFS (Kuhrik et al., 2008; Prion, 2008; Seropian, Brown, Gavilanes, & Driggers 2004; Underberg, 2003) with some of the more enthusiastic proponents of HFS arguing that high fidelity mannequins with realistic weight distribution, joint articulation, breath sounds, bowel sounds, palpable pulses, vocalizations, and feedback mechanisms make the mannequin “almost as good as a real patient” (Grady et al., 2008, p. 404). Others however, advise caution, noting that “simulations are not identical to real life events” (Issenberg et al. 1999, p. 861) and must be employed along with patient interaction to realize its full potential (Kneebone, et al., 2004).

In one of few articles considering the interaction between high fidelity mannequins and humans, Friedman (1995) articulates the essential elements of clinical simulation. In doing so he cautions against extrapolating lifelike qualities to a machine stating that in spite of the advanced technology of HFS, the human-machine interaction is limited to the "unambiguous movement of controls" (p. 206) and lacks the complexity "of the interaction between two human beings who exchange information via verbal and non-verbal language with many nuances and subtleties" (p. 206). Friedman's caution calls attention to the complex health care provider - patient interaction and further supports the need to question what health science students are experiencing when they interact with HFS mannequins.

Chapter 3

3 Methodology

3.1 Conceptual Framework

As I pondered the enormity and potential scope of my inquiry I was forced to peel away and unpack the complexity of educating students to provide health care to patients. Considering the work of Friedman (1995) and Kneebone et al. (2004), and drawing on my experience as a health care provider and educator, I proposed that an essential element that differentiates a clinical experience for a health science student from that of a simulation experience is the interaction that occurs between the student provider and human patients. My conjecture is also supported by Griffin et al. (2004) who conducted a broad review of randomized controlled trials of interventions to alter the interaction between patients and practitioners and conclude succinctly, “successful interactions between patients and their practitioners lie at the heart of medicine” (p. 595).

Stating that “much of what a nurse achieves in her work happens in the course of her action with patients”, Abraham & Shanley (1992) argue that the elements of patient care are dependent upon the nurse and the patient’s ability to understand one another, their ability to communicate and their ability to “modify their behaviour to accommodate the views and response of the other” (p.2). These positions serve to further shape my initial supposition; that health care is dependent upon provider-patient interaction and the significant element of that interaction is the social element.

This position is supported by Ben-Sira’s (1976) work investigating patient satisfaction with their health care. Utilizing a revised approach to social interaction theory to underpin his work, Ben-Sira (1976) determined that social interaction between patient and physician had a more significant influence than did administrative factors, the willingness of the physician to meet the demands of the patient and even the perceived technical competence of the physician by the patient.

As articulated by Ben-Sira (1976) and Grol (1997), social interaction theory serves as a framework for the provider-patient interaction and forms the foundation of this inquiry which investigated the nature of the interaction between health professional students and HFS mannequins.

3.2 Grounded Theory: A Methodological Guide for this Inquiry

The lack of a substantive body of knowledge describing the nature of the interaction that occurs between student health care provider and HFS mannequin necessitate that this inquiry be exploratory and qualitative. Seeking to investigate the nature of patient deaths in hospitals Glaser & Strauss (1965) observed the process of death and its impact on patients and the professionals that cared for them. From their observations they organized and analyzed their data and in doing so created a unique process of methodological strategies in which theories could arise from data obtained, a methodology they identified as Grounded Theory (Glaser & Strauss, 1967) Grounded theory represents an alternative way of knowing as it differs from traditional research methodologies in which testable hypothesis are deduced from pre-existing theories (Charmaz, 2006). Given the absence of existing theories to explain the interaction between student and HFS mannequin, the “systematic, yet flexible guidelines for collecting and analyzing qualitative data” (Charmaz, 2006 p. 2) of Grounded Theory make this methodology a logical choice from which to approach this inquiry. Additional support for utilizing grounded theory for this inquiry is provided by Cutcliffe (2000), who notes that “grounded theory is rooted in symbolic interactionism, wherein the researcher attempts to determine what symbolic meanings, artifacts, clothing, gestures and words have for groups of people as they interact with one another” (p. 1477).

Glaser and Strauss’s (1967) articulation of grounded theory was a well received and prominent methodology adopted by health science (particularly nursing) and social science disciplines throughout the later part of the twentieth century (Charmaz, 2006). However, the popularity of grounded theory has resulted in a variety of “conflicting opinions and unresolved issues regarding the nature and process of grounded theory” (Cutcliffe, 2000, p. 1476), necessitating the need for me, as a novice researcher, to identify a clear roadmap from which to navigate what can be a complex methodology.

Kathy Charmaz’s (2006) work, *Constructing Grounded Theory: A Practical Guide Through Qualitative Analysis* proved to be just such just such a guide.

3.3 Gathering Rich Data

3.3.1 Grounded theory ethnography

What is happening when students interact with a HFS mannequin? Do students converse with the mannequin? What non-verbal behaviour will be evident during the student-mannequin interaction? As a research process that “offers an investigator the opportunity to gather live data from naturally occurring social situations” (Cohen, Manion & Morrison, 2007, p. 398) observation is a logical methodology with which to pursue these and other, as yet undetermined, questions. Bond et al. (2008) also support the use of observation to investigate simulation noting that the “youth of simulation training calls out for high quality, descriptive studies that use good observational tools” (p. 1037). Observation by itself however, would limit the data gathering to what is seen and heard by the researcher, blind to the crucial data such as the cognitive and emotional experiences of the participants. These cognitive and emotional experiences lie at the heart of the research question and to uncover these understandings this inquiry requires a perceptive process that reaches beyond observation to find meaning in what is observed. Ethnography is described as a family of methods that involve engagement with the participants and the rich, respectful, disciplined recoding of their experience to lead to enhanced understanding (Willis and Trondman, 2000). Although she did not study human interactions, Jane Goodall is arguably one of the most famous ethnographic researchers. Immersing herself in civilizations of chimpanzees for decades, her observations and the derivation of meaning that emerged from analyzing these behaviours lead to understandings that were previously unobtainable (Mariampolski, 1999). To access this deeper knowledge and “gain an insider’s depiction of the studied world” (Charmaz, 2006, p. 21) an ethnographic method was employed in which passive observation was thoroughly recorded, analyzed was followed up by interviews with the participants. Identifying grounded theory as a *type* of ethnography Charmaz goes on to articulate that grounded theory ethnography differs from other forms of ethnography in that “grounded theory ethnography gives priority to the studied phenomenon or process – rather than the setting itself" (2006, pg. 22). As the intent of this study is to determine the phenomenon that is occurring when health science students interact with HFS mannequins, grounded theory ethnography is an ideal methodology for this work as it will provide "systematic guidelines for probing beneath the surface and digging into the scene" (Charmaz, 2006, p.23).

3.3.2 Digitally recorded passive observation

Consistent with the exploratory intention, the observation was semi-structured in nature in that I had a small agenda of issues to explore (e.g. verbal communication with the mannequin as opposed to the operator, the existence and nature of physical touch) however the primary intent was to observe what is taking place and to "review the observational data prior to suggesting an explanation for the phenomena observed" (Cohen et al., p. 397).

HFS typically occurs in technologically advanced simulation labs in health science education institutions. Although this environment is an artificially created space intended to represent a clinical setting, the subjects being observed spend time regularly in this space, and as such, this observation would be most accurately described as occurring in a natural setting. These labs are commonly equipped with digital video recording equipment to facilitate high stakes evaluation with the use of simulation. Observation for this study occurred during the student`s usual simulation times while the students were engaged in simulation experiences as they normally do in their lab classes. Using video cameras to gather naturally occurring data is a well-established practice that yields rich results and provides researchers with a mechanism to validate their interpretation (Jewitt, 2012).

Although traditional ethnographic observational techniques involve the investigator immersing themselves in the research setting (Ball, 1997), the presence of existing video recording equipment in the HFS lab areas facilitated data collection without having the presence of an investigator influence the naturally occurring nature of interaction between the students and the HFS mannequins. It was identified that although this approach would likely reduce reactivity to the investigator's presence, the participants were aware that they are being recorded and this may have potentially created reactivity (Cohen et al., 2007), and influenced their engagement with the mannequins. Given the subjects' previous experience and exposure to video recording devices in this environment video recording was utilized instead of investigator immersion as I predicted that the familiarity with the recoding process would produce less reactive effects than would the introduction of an investigator to the environment. Additional benefits of video recording the observations were to minimize the potential negative effects of selective observer attention, attention deficit of the observer, selective observer data entry and expectancy effects (Cohen et al., 2007).

3.3.3 Site of Investigation

This inquiry utilized the health science simulation labs at a large college in Southwestern Ontario.

3.3.4 High Fidelity Simulation Participants

Theoretical sampling is proposed by Glaser and Strauss (1967) as a means to collect data when employing a grounded theory framework to respond to a research question. A key decision for the grounded theory researcher utilizing theoretical sampling to make is "to which group does one turn for data?" (Cohen, et al., 2007, pg. 117). Given as the research question being explored was "What do health science students experience when they interact with high fidelity simulation mannequins in simulated environments?" the participants for this study were elicited from the Health Science student population that were engaged in HFS as a regular aspect of their curriculum.

Recruitment of participants occurred through the use of posters and class presentations inviting voluntary participation in the study. One hundred and sixteen students from across six programs completed consent forms. These consent forms were then compared to existing groupings in the various program lab classes. Typical HFS scenarios involve groups of 2-4 students. As all students in a group had to provide consent to participate in order for that group's HFS scenario to be included in this study, the total number of HFS scenarios available to me was 52. Consistent with the underpinnings of theoretical sampling (Cohen, et al., 2007), participants from two distinct disciplines with dissimilar experience levels was a purposeful intention of the methodological design of this inquiry as I questioned how the varying background of the participants may influence the nature of their interaction with HFS mannequins. Although in the interest of gathering rich, diverse data a broad perspective is arguably preferable, given the constraints of time and resources, it was not feasible to observe the substantial number of HFS scenarios that were available to me as a result of my recruitment. Consistent with the methodology presented in my research proposal, I elected to limit the breath of this inquiry to two disciplines as originally intended.

Advanced Care Paramedic (ACP) and Respiratory Therapy (RT) were the two health science disciplines I elected to include in the participant sample for this study. Both programs utilize HFS environments extensively in their respective curriculum and all participants had previous experience with HFS. The ACP program is a one year graduate program with all students being currently qualified Paramedics in the Province of Ontario. Students in the program are experienced Health Care providers as the admission requirements specify that applicants possess a minimum of 4000 hours of current experience as a working Paramedic. RT is a three year advanced diploma program. The majority of students entering this program have graduated from either a college or university program prior to admission to RT. At the time of this inquiry the RT students were in their second year and had experienced minimal interactions with actual patients as their time in Health Care settings was limited to a small number of observational experiences.

Health science students typically interact with the HFS mannequins in groups. These groups usually range in size from 2 to 4 students per group. I did not modify the structure of the groups in any way but rather observed the students interacting with the mannequins as they typically would in their HFS lab. Twenty five total participants engaged with the HFS mannequins in the 22 HFS simulation scenarios that were included in this study. The HFS scenarios assessed were part of regular class activity and were not test situations. Twenty of the participants were RT students and five were ACP students. Depending upon the natural rotations within their lab classes, some students participated in more than one HFS scenario.

3.3.5 Interviews

Data gathered via observation alone was not likely to yield the deeper knowledge required to formulate an understanding of the participant's experience with the mannequins in HFS as the investigator runs the risk of failing to appreciate the perspective of the subjects and may also fail to understand or misinterpret the social meanings which impact upon the interaction (Foster, 1996). Access to this level of information requires that interviews be conducted with the participants (Kvale, 1996, Charmaz, 2006).

Formulating pre-determined questions was not feasible given the lack of existing substantive data regarding the nature of the interaction between students and HFS simulation mannequins. As a result, an informal conversational interview strategy was employed which built on and emerged from observations (Patton, 1980). Interviews were conducted on campus in standard interview rooms. Given as an intention of HFS is to prepare students for practice in clinical and field environments with actual patients, the interviews were conducted after the students had completed either all or a significant amount of their scheduled time the clinical or field environment. It was predicted that this timing would provide the participants with the ability to compare and contrast their experiences in HFS with their experiences in clinical practice. Data from these interviews was audio recorded and transcribed for analysis. Interviews ranged in length from 19 to 50 minutes with the average interview lasting 30 minutes. Data gleaned from observation of students engaged in HFS was then combined with the data obtained through interview conversations with the participants as a strategy to generate rich, powerful data (Charmaz, 2014, p.23).

3.3.6 Selection of participants interviewed

All students that were observed interacting with the mannequin were asked if they would be willing to be interviewed to discuss their experience. Eleven students from various groups observed volunteered for this phase of my inquiry.

3.3.7 Ethics

The research proposal for this study was submitted to both the Western University Faculty of Education Research Ethics Board (REB) and the Fanshawe College REB for review and approval. After providing some minor clarifications involving choices made in my theoretical sampling (described in 4.2.4 above), the need for observation and assurance that non-participants would not be included in video used in the study, the REBs at both institutions approved this inquiry. All participants were required to provide a signed, informed consent form prior to participating in the study.

3.4 Data Analysis

3.4.1 Unpacking the Video data

As the intent of this work is to better understand what Health Science students experience when engaging in HFS, the first phase of analysis employed was to observe the interactions of the participants to discover what is actually occurring during the HFS scenarios. Although the initial analytic action sounds simplistic, remaining open to discover emerging meanings is critical to the analysis process (Charmaz, 2014). Further comprehensive observation was then employed using traditional grounded theory techniques as developed by Glaser and Strauss, (1967). Although a key element in the successful analysis of data in grounded theory is to remain open to emerging meanings, (Charmaz, 2012), as identified earlier, I observed these interactions through the lens of an experienced practitioner and educator. While it could be argued that this lens has created bias in my data analysis, the argument can also be made that it was through the benefit of this experienced lens that a meaningful understanding of the data emerged that would not have been possible if the data was viewed through the lens of the novice. As a grounded theorist who challenged the assertion that meaningful data analysis could only arise from a non-influenced perspective, Dey (1999) asserted, "there is a difference between an open mind and an empty head"(p. 251).

In keeping with grounded theory tradition the purpose of observation is to create codes from the data. This activity is known as coding and is described by the pivotal grounded theory authors (Glaser, 1992; Straus and Corbin 1990) as the essential process to derive meaning from data by assigning labels to segments that describe what each segment is about (Charmaz, 2003). This critical step is best articulated by Charmaz, (2014) as she noted that “coding is the pivotal link between collecting data and developing an emergent theory to explain these data. Through coding, you define what is happening in the data and begin to grapple with what it means” (p. 113). A key element of successful coding is to have the codes emerge from the data rather than fitting the data into predetermined codes or categories. In this way, grounded theory furthers understanding, rather than limiting it (Charmaz, 2006, p. 46).

In this work I elected to analyze the video data collected using incident-to-incident coding (Charmaz, 2014, p. 128) as the interactions and activities of the participants added richness that could not be captured using a line by line coding of conversations that were occurring in the video data. I created the incident codes as I observed the interactions occurring. As more data were analysed more codes emerged and added to the list of coded incidents. The time that the coded incident occurred in each HFS was recorded to allow for validation on review.

In a traditional grounded theory data analysis, as the researcher compiled initial coding, a central theme would emerge and be identified. In a process known as *axial coding* (Strauss & Corbin, 1990) the analysis would be furthered by systematically determining the relationships of the numerous themes identified in the data to central phenomenon or *axis*. (Charmaz, 2014; Tryssenaar, 2004). The benefit of axial coding is that it creates a frame around which the researcher can shape his or her analysis, however as several authors note, the structure associated with axial coding can limit the researcher’s ability to envision the broader scope and diverse meanings existent in data (Charmaz, 2014; Kendall, 1999).

In contrast, focused coding allows the researcher to bring their experienced perspectives to the table to determine what the initial codes say, define their meaning, make comparisons with and between them to examine large amounts of data (Charmaz, 2014). In consideration of the diversity of data collected and recognizing that I personally prefer to not be constrained by a frame and work well with “messiness”, I elected to forgo axial coding and employed the more diverse, emergent focused coding process to advance my data analysis.

3.4.2 Expanding understanding through interview conversations

The intent of the interview process was to validate or ground the meanings derived from the coding of the observed student mannequin interactions in the HFS scenarios. The video allowed me to see what was occurring, the interviews allowed me to validate my observations and also provided the opportunity to explore what the students were thinking and feeling as they participated in the HFS scenarios. During the interview I reviewed the video recording of the participants' HFS scenario with them. This was done to facilitate the recall of the participants, and it prompted them to comment on their actions as they observed themselves in the HFS scenario. Further insights were elicited from the students during the interview with a reliance on open ended questions. The above methodology was intentionally designed to glean insight into what the participants were experiencing when they engaged in HFS simulation by asking them to comment on their actions as they observed themselves. The methodology employed in this work is relatively unique in the literature as a common approach in many investigations is to survey health science students on their perceptions of HFS after their experience (Kable, Arthur, Levett-Jones, & Reid-Searl, 2013; Pike & O'Donnell, 2010; Reilly and Spratt, 2007) without the benefit of being able to observe themselves to enhance their recall. Exploring the participants' perspectives on their experience with HFS in this manner is consistent with what Charmaz describes as "Intensive Interviewing" and is an effective technique to explore hidden intentions (Charmaz, 2014 p. 57).

To allow to develop a "Gestalt" or whole perspective it is effective to first read all data in their entirety (Tryssenaar, 2004, p. 72). After this first reading I then re-assessed each interview and completed initial coding of the data. The data was then further analyzed and emergent themes were identified from synthesis and categorization of the initial codes. This progression aligns with the process of focused coding as articulated by Charmaz and serves as an effective course to derive meaning from interview data (Charmaz, 2004, p. 57). Themes that emerged from the interview data were then compared and related to the focused codes as derived from the video data of the HFS scenarios.

3.5 Summary

Social interaction theory serves as the framework for the provider-patient interaction and forms the foundation of this inquiry which investigated the nature of the interaction between health professional students and HFS mannequins. In providing a flexible, dynamic process by which meanings and themes are encouraged to emerge from data, grounded theory was selected as methodological guide to explore the research question. Participants were recruited from a large postsecondary institution in South Western Ontario and data was collected utilizing an ethnographic approach in which video recorded passive observation was followed by interviews with the participants. Data analysis was completed using incident coding and focused coding techniques as advocated by Charmaz (2006, 2014). Emergent themes and meanings were then further explored and validated in interview conversations. I will review the findings that emerged from the data in the next chapter.

Chapter 4

4 Findings

“HFS enables the reproduction of problems and realistic holistic patient situations that are close to clinical practice by the use of advanced technology and arranged environments” (Tosterud, Hedelin, & Hall-Lord, 2013, p. 262). But how close? In the context of the research question is the experience of the student participating in HFS close to what they experience in clinical practice or, is it something different? This chapter will first present data derived from the observation of students engaged in HFS and my initial coding of incidents in the simulations as viewed through the lens I possess from having spent years as a practitioner and educator in clinical environments. I will then share the focused coding and understandings that emerged from the analysis as well as the data derived from the post simulation interviews. This data will then be used to support the discussion created by the research question.

4.1 General Observations

The HFS scenarios assessed in this study depicted a wide variety of patient situations that the student participants could likely expect to encounter in actual clinical settings. The simulated situations involved patients who had: fallen from a two story roof, suffered extensive burns and an inhalation injury from a fire, been hit by a car and suffered multiple trauma, been stung by a bee and were suffering from anaphylactic shock, suffered respiratory arrest as a result of being born prematurely, experienced shortness of breath as a result of asthma, experienced difficulty breathing as a result of aspiration and experienced difficulty breathing as a result of an abdominal aortic aneurysm. Infant, child and adult HFS mannequins were employed in the various scenarios to replicate the age and size of the patient situation being simulated. The majority of the scenarios were conducted in the simulation labs with the HFS mannequins positioned in hospital style beds or an infant warming bed to represent patients in a particular setting. In some of the scenarios the setting was created out of doors to align with the practice environment of the discipline. For example, in the situation where the patient had fallen from the two story roof, the HFS mannequin was positioned outside, beside the exterior wall of a two story building, bent over a parking barricade with construction materials underfoot. Other scenarios occurred in the back of an Ambulance with the HFS mannequin being transported to `hospital` while the Ambulance vehicle was driven around the grounds of the college. Two scenarios observed depicted a situation where a patient had suffered serious multiple trauma from a collision with a motor vehicle and was found on a roadway. However the scenario had the HFS mannequin positioned on the floor of the health science lab beside a hospital style bed. Students in this scenario were required to visualize the scene as it was described to them which was significantly different than the environment they were experiencing. The scenario topics, the discipline that completed each scenario and the location that the simulation was completed in is summarized in Table 1.

Table 1

Summary of HFS by topic, discipline and location

Scenario #	Discipline	Topic	Location
1	ACP	Fall from Height	Ambulance
2	ACP	Multiple Trauma - Arrest	Ambulance
3	ACP	Extensive Burns, Inhalation Injury	Sim Lab
4	ACP	Multiple Trauma, MVC	Sim Lab
5	ACP	Multiple Trauma, MVC	Sim Lab
6	ACP	Anaphylaxis - Arrest	Ambulance
7	ACP	Extensive Burns, Inhalation Injury	Sim Lab
8	ACP	Fall from Height	Outdoors
9	RT	Neonate Resuscitation	Sim Lab
10	RT	Child Respiratory Distress	Sim Lab
11	RT	Inhalation Injury from House Hire	Sim Lab
12	RT	Adult Respiratory Distress	Sim Lab
13	RT	Inhalation Injury from House Hire	Sim Lab
14	RT	Adult Respiratory Distress	Sim Lab
15	RT	Adult Respiratory Distress – Abdominal Aneurism	Sim Lab
16	RT	Inhalation Injury from House Hire	Sim Lab
17	RT	Adult Respiratory Distress - Aspiration	Sim Lab
18	RT	Neonate Resuscitation	Sim Lab

19	RT	Neonate Resuscitation	Sim Lab
20	RT	Child - Respiratory Distress - Arrest	Sim Lab
21	RT	Adult Respiratory Distress - Aspiration	Sim Lab
22	RT	Inhalation Injury from House Hire	Sim Lab

Although the scenarios depicted both male and female patients, the mannequins were generic in appearance and lacked observable gender specific features. The intended gender of the HFS mannequin was often visually portrayed using wigs and or clothing. The computer modified voice of the mannequin was typically set up to replicate a male, female or child patient as required. It was noted that although the HFS mannequins could produce a host of physical manifestations appropriate to the clinical situation at hand including palpable pulses, blood pressure, chest wall movement, both normal and abnormal breath sounds and swelling of the tongue, the generic appearance of the mannequin remained unchanged. In other words, a HFS mannequin that was suffering a cardiac or respiratory arrest appeared the same as a HFS simulation mannequin that was well.

HFS scenarios are typically designed to represent one situation or patient interaction. Once a student group completes a scenario, the scene is reset and another group of students engages in the same or similar scenario. The scenarios included in this study ranged in length from 8.4 minutes to 31 minutes. The ACP scenarios averaged 17.6 minutes and the RT scenarios averaged 14.6 minutes. Of the 22 scenarios assessed only three went beyond 20 minutes. The longer duration situations were ACP scenarios that involved more time consuming procedures (e.g. placing the patient on a backboard and extricating them from a scene). It was noted in several of the scenarios that the instructor would intervene and "call" (end) a scenario stating, "why don`t we stop there", or "that's good". Controlling the length of the scenario to align with a schedule is a common practice in HFS (Mahoney, Hancock, Iorianni-Cimback, & Curley, 2013, pg. 650). Other times the scenario was allowed to end as it naturally would in a patient care setting with the students terminating the interaction in a manner similar to what you would expect in a clinical environment, for example "goodbye Jack, I hope you get feeling better".

The simulated patients were assigned names to facilitate the student – mannequin interaction. Often, these assigned names would be random as would be expected in a real life interaction, for example “Jane Simpson”, “Mr. Jones” or “Fred”. However, during one scenario it was noted that the patient’s name was obviously intended to be reflective of the situation with a humourous or perhaps even a macabre intent. The patient had suffered burn injuries in a fire and was named “Mr. Frye”.

It was also observed that the patient situations depicted in the HFS scenarios overwhelmingly presented patients that where critically ill. Despite the random convenience sampling method employed in this work, in 19 of the 22 HFS assessed the patient either arrested or required resuscitative measures.

I will now move from these general observations to a description of the incidents in each scenario.

4.2 Finding meaning in what I observed

4.2.1 Initial Coding of Incidents

As I initially observed the video recordings of the 22 HFS scenarios I documented activities (incidents) by making “behaviouristic descriptions” (Charmaz, 2006, p. 63) of the student’s actions as they occurred in the HFS scenario. Although I was embracing a passive ethnological methodology in this inquiry, I did understand the context of the various scenarios and therefore did not record every movement or action but rather looked for nuances and behaviours that would provide insight into what the student was thinking, feeling or experiencing as they engaged in the scenario. To illustrate this concept, consider that one of the first steps to initiate a successful patient interaction is to introduce yourself. As this is an expected occurrence I could derive little meaning from the fact that this incident occurred and therefore I did not document it. However, what I did note and document was what the student was doing when they made the introduction. Did they make eye contact with the mannequin? Make an appropriate nonverbal gesture? Or, did they look at the control room when they spoke to the mannequin?

As I spent more time with the video data I began to realize that the entire environment of the HFS scenario was influencing the students' experience and there was meaning to be discerned throughout the whole the HFS scenario that went beyond the student – mannequin interaction. Using this broader lens my incident coding expanded to consider other occurrences, such as: Was the person acting as the patient's family member another student dressed in a student uniform or were they in street clothes? What was the nature of the instructor interaction in the scenario? Did people participating in the scenario stay true to character or did they play multiple roles? Did the conversation of the role players flow naturally or were they reading from scripts? By the time I had completed my initial coding of incidents I had identified more than 60 codes from the video data. In most scenarios I was identifying an average of 4 coded incidents per minute of video. A list of the incident codes identified in the video data can be found in Table 2.

Table 2

HFS Incident Codes

CODE	LEGEND
ABNOS	Anxious behaviour no observable stimulus
ABWS	Anxious behaviour with stimulus
AEU	Actual equipment used
AQI	Asks question of instructor
ASF	Asked for help
BDC	Bystander dressed correctly
BIU	Bystander in uniform
BRFS	Bystander reading from script
DI	Dynamic interaction >1 student
DOC	Documentation
EC	Eye contact when speaking to patient
EISUP	Equipment incorrectly setup
ES	Equipment substituted
ESUP	Equipment set up properly
EV	Equipment missing but verbalized that it was present
FA	Fooling around
G	Giggling / grinning (inappropriate)

IBI	Initiates bystander interaction
IBS	Interaction between students
ICC	Initiates casual conversation
ICP	Incomplete procedure
IIU	Instructor initiated urgency
ILS	Instructor leading scenario
IPINPR	Initial patient interaction non procedure related
IPITV	Initiate patient interaction to validate
IPMR	Instructor plays multiple roles
IQ	Instructor quizzing
LAC	Looking at camera
LAP	Looking at programmer / instructor
MPNMS	Mannequin presentation does not match scenario
NCIPFC	No change in position for communication
NEC	No eye contact when speaking to patient
NPPE	No personal protective equipment worn when required
NRVT	Non respectful vocal tone
NU	No uniform (where it would be expected to be worn)
OE	Open ended question
OSI	One student interacts while others watch
PA	Pretend activity
PCP	Physical contact for procedure
PDAF	Patient derived assessment findings
PE	Procedure explained
PFC	Positions self for communication
PI	Practitioner interaction
PPAF	Programmer / instructor providing assessment findings
PPBP	Patient/programmer/bystander prompting student
PPC	Procedure performed completely
PPE	Personal protective equipment worn as required
PWE	Playing with equipment
RBI	Responding to bystander interaction
RHP	Rough handling of patient
RPC	Responds to patient comment
RPC	Role players consistent
RPP	Responds to patient presentation
RPSR	Role players switch roles
RVT	Respectful vocal tone
SAFFP	Seeking assessment findings from programmer
SDP	Seeking direction from programmer
SEP	Solves equipment problem
TT	Therapeutic / comfort touch

TTPLAP	Talking to patient while looking at programmer / instructor
U	Uniform
VAT	Verbalizing activity (test)
W	Whispering (as in a test situation)
YN	Yes / No question

4.2.2 Discovering Meaning in Absent Behaviours

The incident codes listed in Table 2 arose from my observation and evaluation of what I detected occurring in the data. It soon became apparent however, that there was also significant meaning emerging from what was not occurring. In other words, in many situations I was not seeing an action or incident occur that I would expect to see if the HFS scenario was an actual patient situation. As an illustration, in one scenario a simulated newborn premature baby begins to deteriorate and progresses to respiratory arrest. The students manage the high intensity situation but do not display behaviours consistent with an increase in anxiety or urgency. On the one hand this could be interpreted as confidence or significant previous experience with this situation. On the other hand however, given as even experienced practitioners will describe neonate resuscitations as anxiety producing events it is an unlikely explanation that neophyte care providers possess the confidence and experience to allow them to calmly function in such a high stakes event. What were the students perceiving that allowed them to avoid anxiety in this situation? As it became apparent that there was meaning to be discovered in behaviours that were absent as well as behaviours that occurred in the data the incident code list was expanded to include absent expected incidents. A list of these absent expected incident codes is presented in Table 3.

Table 3

Absent Expected Incident Codes

CODE	LEGEND
ABE	Absent bystander engagement
ADOC	Absent documentation when expected
AIBS	Absent interaction between students
API	Absent practitioner interaction
ATT	Absent comfort touch
GIPC	Obvious Gap in communication with patient
IB	Ignores /oblivious to bystander
IPC	Ignores patient comment
IPP	Ignores patient presentation
LAB	Lack of anxious behaviour when patient deteriorating
NCIPFC	No change in position for communication
NQA	No questions asked (as in a test)
PNE	Procedure not explained

4.2.3 Focused Coding

As I continued to examine, assess and compare these initial codes what began to emerge for me was the understanding that there were many incidents, such as making eye contact when speaking to the mannequin, where the students conducted themselves in the scenario and engaged with the HFS mannequins as they would an actual patient. However, I also noted that there were numerous incidents that were not consistent with a patient interaction. A comparative incident to illustrate this distinction would be the student speaking to the mannequin but looking at the control room where the out of site instructor was generating the patient's verbal responses. Considering this comprehension within the context of social interaction theory lead me to organize my initial codes into two broad yet distinct categories. Those incidents that were consistent with a patient interaction were placed in one category and those incidents that were less consistent with a patient interaction were placed in another. The categorized list of incidents reflecting this distinction is found in Table 4.

Table 4

Incidents More Consistent with Patient Interaction		Incidents Less Consistent with Patient Interaction	
CODE	**LEGEND**	**CODE**	**LEGEND**
ABNOS	Anxious behaviour no observable stimulus	ABE	Absent bystander engagement
ABWS	Anxious behaviour with stimulus	ADOC	Absent documentation when expected
AEU	Actual Equipment used	AIBS	Absent interaction between students
AQI	Asks question of Instructor	API	Absent practitioner interaction
ASF	Asked for help	ATT	Absent comfort touch
BDC	Bystander dressed correctly	BIU	Bystander in uniform
DI	Dynamic interaction >1 student	BRFS	Bystander reading from script
DOC	Documentation	EISUP	Equipment incorrectly setup
EC	Eye contact when speaking to patient	ES	Equipment substituted
ESUP	Equipment set up properly	EV	Equipment missing but verbalized that it was present
IBI	Initiates bystander interaction	FA	Fooling around
IBS	Interaction between students	G	Giggling / grinning (inappropriate)
ICC	Initiates casual conversation	GIPC	Obvious gap in communication with patient
IPINPR	Initial pt. interaction non procedure related	IB	Ignores/oblivious to bystander
IPITV	Initiate patient. interaction to validate	ICP	Incomplete procedure
OE	Open ended question	IIU	Instructor initiated urgency
PCP	Physical contact for procedure	ILS	Instructor leading scenario
PDAF	Pt derived assessment findings	IPC	Ignores patient comment
PE	Procedure explained	IPMR	Instructor plays multiple roles
PFC	Positions for communication	IPP	Ignores patient presentation
PI	Practitioner Interaction	IQ	Instructor quizzing
PPC	Procedure performed completely	LAC	Looking at camera

PPE	Personal protective equipment	LAB	Lack of anxious behaviour when patient deteriorating
RBI	Responds to bystander interaction	LAP	Looking at programmer/ instructor
RPC	Role players consistent	MPNMS	Mannequin presentation does not match scenario
RPTC	Responds to patient comment	NCIPFC	No change in position for communication
RPP	Responds to Pt presentation	NEC	No eye contact when speaking to pt
RVT	Respectful vocal tone	NPPE	No personal protective equipment worn when required
SEP	Solves equipment problem	NQA	No questions asked (as in a test)
TT	Therapeutic / comfort touch	NRVT	Non respectful vocal tone
U	Uniform	NU	No uniform (where it would be expected to be worn)
YN	Yes / No question	OSI	One student interacts others watch
		PA	Pretend activity
		PNE	Procedure not explained
		PPAF	Programmer providing assessment findings
		PPBP	Pt/programmer/bystander prompting student
		PWE	Playing with equipment
		RHP	Rough handling of patient
		RPSR	Role players switch roles
		SAFFP	Seeking assessment finding from programmer
		SDP	Seeking direction from programmer
		TTPLAP	Talking to pt. while looking at programmer / instructor
		VAT	Verbalizing activity (test)
		W	Whispering (as in a test situation)

Although this is not a quantitative study, I found myself drawn to the question of which category of incidents was occurring with greater frequency? However, appreciating that insight into the research question exploring what students are experiencing in high fidelity simulation warrants a greater complexity than adding up the number of times a particular incident occurred I also began to explore relationships between incidents. For example, what is the relationship between incidents of student actions that were less associated with a patient interaction and instructor actions that were less associated with a patient interaction? As an evaluation of how often these incidents from the two categories are occurring does provide insight and expand understanding of the data I will first explore the frequency of incidents more consistent with patient interaction and compare that to the frequency of incidents less consistent with patient interaction. I will then discuss ways in which the frequency of the categorized incidents informs further qualitative analysis. Following that I will present the relationships that emerged between incidents.

4.2.4 Comparing Incidents More consistent with Patient Interaction to Incidents Less Consistent with Patient Interaction

A review and comparison of the frequency of the incidents more consistent with a patient interaction (*i**M**cwpi*) to that of the frequency of the incidents less consistent with a patient interaction (*i**L**cwpi*) in the HFS scenarios reveals a wide variety of variation. One HFS scenario has the same number of *i**M**cwpi* as *i**L**cwpi*. Of the remaining scenarios the frequency distribution was almost evenly split with 9 of 21 HFS scenarios having more *i**M**cwpi* than *i**L**cwpi* and the remaining 11 having more *i**L**cwpi*. A summary of the occurrence rates of *i**M**cwpi* and *i**L**cwpi* as they were identified in each scenario can be found in Table 5.

Table 5

Frequency of Incidents noted in HFS Scenarios

Scenario Number	# of incidents more consistent with a patient interaction	# of incidents less consistent with a patient interaction
1	15	18
2	5	20
3	19	69
4	13	47
5	26	37
6	33	16

7	42	26
8	15	55
9	23	18
10	22	28
11	23	19
12	34	4
13	15	15
14	39	11
15	13	35
16	16	25
17	57	21
18	26	11
19	6	16
20	10	26
21	32	9
22	11	21

Overall, 47% of all incidents recorded were classified as *i**M**cwpi* and 53% were classified as *i**L**cwpi*. Although numeric representations are often associated with increased validity, as all of the incidents are not equal in their meaning it would be inaccurate to assign unintended meaning from this simple math analysis of the qualitative data collected. That being said it, what Table 4 does illustrate, is that there is significant amount of activity occurring in the HFS scenarios evaluated that is not consistent with a patient interaction. While there are limitations to the meaning that can be derived from numerical assessment of the categorized incidents, the frequency of occurrence of incidents can be used to further explore what students experience when they interact with high fidelity simulation mannequins.

4.2.5 The impact of Design and Delivery incidents on the student experience

As noted earlier, my review of the data revealed that there were incidents occurring in the design and delivery of the HFS scenarios that were beyond the student's control but could potentially be influencing the student's experience. As such, I included these design and delivery elements in the initial coding. An example of this type of design and delivery incident would include the person playing the parent in a simulation being a classmate dressed in uniform rather than street clothes. An additional example would include the faculty member running the scenario verbally providing assessment findings that were either not able to be discovered on the HFS mannequin or were different than what was assessed by the student. Considering these design and delivery elements prompted me to question what relationships exist between the design and delivery of the HFS scenario and the student's ability to engage with the mannequin as they would with an actual patient? Within the 22 HFS scenarios in this study, six scenarios were repeated more than once, providing me with the opportunity to compare the video data from different groups of students engaging in the same HFS scenario. If the same faculty member / programmer was leading the HFS scenario, the HFS mannequin presentation was consistent and the design and delivery of the scenario was similar would the student's experience as assessed by the occurrence of *i**M**cwpi* and *i**L**cwpi* also be similar?

Scenario 12 and scenario 14 were the same situation and given as they were completed by two different student groups these scenarios presented the opportunity to consider the question above. As you can see from Table 5, the *i**M**cwpi* and the *i**L**cwpi* for both scenarios were comparable, with significantly more *i**M**cwpi* being observed in both scenario 12 and 14. This finding also remains consistent when the design and delivery incidents are removed from the coding and only student actions are considered. This would imply that if the design and delivery features are consistent then the student's experience will also be consistent. Table 6 illustrates the scenarios that present similar situations and the *i**M**cwpi* and *i**L**cwpi* for each.

Table 6

HFS Scenarios presenting similar situations

Similar Scenarios	Scenario Number	Total Incidents	*i**M**cwpi*	*i**L**cwpi*
3 and 7	3	88	19	69
	7	68	42	26
4 and 5	4	60	13	47
	5	63	26	37

9, 18 and 19	9	41	23	18
	18	37	26	11
	19	22	6	16
11, 13, 16 and 22	11	42	23	19
	13	30	15	15
	16	41	16	25
	22	32	11	21
12 and 14	12	38	34	4
	12	50	39	11
17 and 21	17	78	57	21
	21	41	32	9

Interestingly however, the same finding does not emerge when this comparative lens is applied to the remaining similar HFS scenarios. While scenarios 4 and 5 have almost identical number of incidents noted with a similar distribution between *i**M**cwpi* and *i**L**cwpi*, scenarios 3 and 7 present entirely different picture with the *i**M**cwpi* and the *i**L**cwpi* being almost reversed. Likewise, scenarios 17 and 21 are consistent but 11, 13, 16 and 22 present widely varying results. The lack of consistency that arises when the relationships between the prevalent incident categories emerging in similar scenarios is explored, calls me to question if the design and delivery features of HFS impact the ability of the student to perceive the HFS as a real life event to level implied in the literature.

Analysis of the above data allowed for constructed understanding that consistency in design and delivery features does not reliably influence the occurrence of incidents that are either more or less consistent with a patient interaction. This emerging understanding does not readily align with the logical and prevailing arguments in the literature which articulates that the more realistic the design and delivery of the HFS simulation the more effective the experience is for the health science student (Branch, 2013; Epps, White and Trofil, 2013; Mahoney et al., 2013). The understanding noted above emerged from exploring the relationships between *i**M**cwpi* and *i**L**cwpi* as they occurred in scenarios with consistent design and delivery features. I will now consider the relationships between the incident categories when design and delivery features vary.

To explore the relationship between the occurrence of student behavior incidents more or less consistent with patient interaction, and design and delivery features more or less consistent with patient interaction, I focused coding of the data to identify incidents arising from design and delivery elements from that of incidents arising from student behavior. Table 7 illustrates the results of this expanded focused coding.

Table 7

Incidents arising from student behavior and incidents arising from design and delivery features.

Incidents arising from student behavior are shown as shaded

Incidents arising from design and delivery features are shown as unshaded.

Incidents More Consistent with Patient Interaction		Incidents Less Consistent with Patient Interaction	
CODE	**LEGEND**	**CODE**	**LEGEND**
ABNOS	Anxious behaviour no observable stimulus	ABE	Absent bystander engagement
ABWS	Anxious behaviour with stimulus	ADOC	Absent documentation when expected
AEU	Actual Equipment used	AIBS	Absent interaction between students
AQI	Asks question of Instructor	API	Absent practitioner interaction
ASF	Asked for help	ATT	Absent comfort touch
BDC	Bystander dressed correctly	BIU	Bystander in uniform
DI	Dynamic interaction >1 student	BRFS	Bystander reading from script
DOC	Documentation	EISUP	Equipment incorrectly setup
EC	Eye contact when speaking to patient	ES	Equipment substituted
ESUP	Equipment set up properly	EV	Equipment missing but verbalized that it was present
IBI	Initiates bystander interaction	FA	Fooling around
IBS	Interaction between students	G	Giggling / grinning (inappropriate)
ICC	Initiates casual conversation	GIPC	Obvious gap in communication with patient
IPINPR	Initial pt. interaction non procedure related	IB	Ignores/oblivious to bystander

IPITV	Initiate patient. interaction to validate	ICP	Incomplete procedure
OE	Open ended question	IIU	Instructor initiated urgency
PCP	Physical contact for procedure	ILS	Instructor leading scenario
PDAF	Pt derived assessment findings	IPC	Ignores patient comment
PE	Procedure explained	IPMR	Instructor plays multiple roles
PFC	Positions for communication	IPP	Ignores patient presentation
PI	Practitioner Interaction	IQ	Instructor quizzing
PPC	Procedure performed completely	LAC	Looking at camera
PPE	Personal protective equipment	LAB	Lack of anxious behaviour when patient deteriorating
RBI	Responds to bystander interaction	LAP	Looking at programmer/ instructor
RPC	Role players consistent	MPNMS	Mannequin presentation does not match scenario
RPTC	Responds to patient comment	NCIPFC	No change in position for communication
RPP	Responds to Pt presentation	NEC	No eye contact when speaking to pt
RVT	Respectful vocal tone	NPPE	No personal protective equipment worn when required
SEP	Solves equipment problem	NQA	No questions asked (as in a test)
TT	Therapeutic / comfort touch	NRVT	Non respectful vocal tone
U	Uniform	NU	No uniform (where it would be expected to be worn)
YN	Yes / No question	OSI	One student interacts others watch
		PA	Pretend activity
		PNE	Procedure not explained
		PPAF	Programmer providing assessment findings
		PPBP	Pt/programmer/bystander prompting student
		PWE	Playing with equipment
		RHP	Rough handling of patient
		RPSR	Role players switch roles
		SAFFP	Seeking assessment findings from programmer
		SDP	Seeking direction from programmer
		TTPLAP	Talking to pt. while looking at programmer / instructor
		VAT	Verbalizing activity (test)
		W	Whispering (as in a test situation)

When the design and delivery features of a scenario vary does the student's ability to engage in the scenario as they would a real life event also vary? What is the relationship, if any, between these incidents? To explore these questions the focused coding presented in Table 7 was then applied to the ***iM**cwpi* and ***iL**cwpi* data from 22 scenarios in this study. This analysis yielded the results presented in Table 8.

Table 8

Breakdown of Incidents More consistent with Patient Interaction (*i**M**cwpi*), Incidents Less Consistent with Patient Interaction (*i**L**cwpi*), Design and Delivery Features and Student Behaviours by Scenario

Scenario Number	*i**M**cwpi* arising from Design and Delivery	*i**M**cwpi* arising from Student Behaviours	*i**L**cwpi* arising from Design and Delivery	*i**L**cwpi* arising from Student Behaviours
1	2	13	12	6
2	0	5	16	4
3	7	12	15	54
4	5	8	27	20
5	14	12	23	14
6	13	20	5	11
7	14	28	20	6
8	7	8	27	28
9	15	8	4	14
10	5	17	1	27
11	16	5	13	6
12	8	26	0	8
13	6	9	1	14
14	5	34	0	11
15	3	10	8	27
16	6	10	11	14
17	12	45	5	16
18	14	11	5	6
19	3	3	3	13
20	2	8	2	24
21	11	21	4	5
22	4	7	10	11

At first blush this appears to be a confusing chart of unrelated numbers, however meaning does begin to materialize when we look at the relationships emerging in this data. In scenarios 6, 9, 10, 11, 12, 13 17, 18, and 21 the design and delivery *i**M**cwpi* are greater than the design and delivery *i**L**cwpi*. Does this increased prevalence of design and delivery incidents more consistent with patient interaction in a scenario positively influence student behavior and result in a more student behaviours that are consistent with a patient interaction? Assessing the data further reveals that student behavior *i**M**cwpi* are greater than student behavior *i**L**cwpi* in scenarios 1, 2, 6, 7, 12, 14, 17, 18, and 21. Comparing the two lists reveals that in 6 of the 10 scenarios in which design and delivery *i**M**cwpi* were more prevalent, student behavior *i**M**cwpi* were also more prevalent. However, in 4 of the 10 scenarios increased design and delivery *i**M**cwpi* was associated with an increase in student behavior *i**L**cwpi*.

Considering the relationship between varying design and delivery incidents and student behavior incidents from the opposite perspective, in HFS scenarios 1, 2, 3, 4, 5, 7, 8,15, 16, 20 and 22 the design and delivery *i**L**cwpi* are greater the design and delivery *i**M**cwpi*. Comparing these two list reveals that in 8 of the 10 scenarios in which design and delivery *i**L**cwpi* are more prevalent student behavior is also more prevalent.

On the surface this analysis implies that there is a relationship in this data between design and delivery incidents and student behavior incidents whereby if a scenario is designed and delivered in greater alignment with a patient interaction then the students participating in the scenario will demonstrate a greater number of behaviours consistent with a patient interaction. However, this interpretation may be a bit premature when it is identified that the data also reveals that in 1/3 (7) of HFS scenarios the relationship between design and delivery incidents was opposite to the student behavior incidents identified. For example, in scenario 1 there were six times more design and delivery *i**L**cwpi* than design and delivery *i**M**cwpi* yet in the same scenario almost twice as many student behavior incidents more consistent with a patient interaction were identified. A similar relationship emerged in scenario 9. In this neonatal resuscitation simulation, 15 design and delivery incidents more consistent with a patient interaction were identified as opposed to 4 design and delivery incidents less consistent with a patient interaction, yet the students demonstrated almost twice as many behaviours that were less consistent with a patient interaction. Despite the high fidelity of the scenario (the simulation was more lifelike) the student's behaviours were less consistent with real life.

Comparing the frequency of occurrence of the incident and focused codes was not intended to journey into quantitative analysis but was embarked upon to explore the relationship between the design and delivery elements of an HFS scenario and the student behaviours demonstrated while participating in the scenario. In other words, if the HFS was designed and delivered in ways that made it more realistic (having a greater number of *i**M**cwpi*) did the students act more like they were engaging with a real patient (demonstrating a greater number of *i**M**cwpi*)? Although the data analysis comparing the elements of design and delivery to student behavior is inconclusive, these findings do cast question on the arguments put forth by many in the literature that increasing the fidelity of the mannequin and the realism of the scenario will result in the creation of a lifelike experience for the participants (Gaba, 2004).

4.2.6 A summary of the meanings that emerged from analysis of coded data

In analyzing the video data, a large number of significantly varying incidents were identified and coded as the health science students interacted with the mannequins and participated in HFS scenarios. It was noted that at times the students engaged in the scenarios and interacted with the computer processed mannequins as one would expect if the student was interacting with an actual patient. However, with a similar frequency of occurrence, numerous behaviours were observed in the HFS scenarios that were not consistent with an actual patient interaction. Given the large variety and frequent occurrence of observed behaviours that were not consistent with a patient interaction it is reasonable to suspect that the health science students participating in this study often were often not experiencing the HFS scenario as they would an actual patient situation.

Additionally it was noted that there was also a frequent absence of behaviours that one would expect to see if the participants were experiencing the simulation in a manner consistent with an actual patient situation. This finding further questions if the participant's experience with HFS mannequins and simulated environments is similar to the experience in the clinical environment that HFS scenarios are often replacing in today`s health science education curriculum.

Throughout the HFS scenarios observed it was noted that many details of design and delivery were often incorporated into the scenarios to make the learning environment appear like the clinical setting the scenario was intended to simulate, or in other words, the fidelity, (the extent to which a simulation matches the appearance and behaviour of the reality it is endeavoring to emulate), of the simulations was often high. Logically, if the fidelity of the simulation is high (the scenario is more life-like) one would expect that the student behaviours in the HFS scenario would be more consistent with a real life event. In other words, the more life-like you make the simulation, the more the people engaging in the simulation will act like the simulation is real. While this position is also commonly reflected in the literature the data emerging in this work does not completely support this position. While many of the observed scenarios with high levels of design and delivery elements that were consistent with a patient interaction (higher in fidelity) also had a higher number of incidents more consistent with a patient interaction, 1/3 did not. Additionally, in some of the HFS scenarios, the response to higher fidelity was the opposite to the logical expectation, with a lower frequency of incidents more consistent with a patient interaction and higher frequency of incidents less consistent with a patient interaction. This observation calls me to question the prevailing notion that continued enhancements to the fidelity of patient care simulations will result in an enhanced ability of the participants to perceive the event as life like.

As noted previously, despite the numerous positive impacts of HFS simulation on health science education, predominately absent in the HFS literature is the determination of the level to which students engaging in HFS simulation perceive the event as real. This gap lies at the heart of the research question and requires further analysis of the data that will look for deeper meaning in the incidents observed in the HFS scenarios.

4.3 Exploring the significant incidents

Analysis of the video data in the previous section revealed multiple understandings including that the most frequent occurrence in the HFS scenarios were incidents that were less consistent with a patient interaction. That analysis was helpful in that it provided a comprehensive look at a large amount of data. However, the research question exploring what health science students experience in HFS can be further served by searching for what I describe as significant incidents. Incidents that convey powerful meaning and inherently provide a greater level of insight into what the student is experiencing in the HFS scenario.

4.3.1 Significant Incidents Less Consistent with a Patient Interaction

The first such incident occurs in scenario 9. In this HFS scenario a premature infant is experiencing respiratory distress and deteriorates throughout the scenario. As the infant's conditions worsens and becomes critical, the student notes that the infant "can't breathe" and then laughs. Not a nervous laugh but a laugh that indicates that the participant is interpreting the situation as funny. Having experienced numerous resuscitative events I can assure the reader that there is little that can be perceived as humourous when you are trying everything possible to save a life.

Likewise, in Scenario 1, the patient has suffered a cardiac arrest and was being transported to hospital via ambulance. During transport, the students were attempting to secure his airway by endotracheal intubation and the ambulance travelled over several bumps. During each of the bumps, several participants laugh deeply. They are clearly perceiving the situation as humourous even though they are struggling to secure an airway for the simulated patient. If they are unable to secure the airway, death of the simulated patient is a real possibility. Again, in reality, this situation is far from a humourous event.

During Scenario 5, a student who is not the primary care provider is tasked with managing the patient's airway and artificially ventilating the patient. This student responds to a question from a another student playing the role of a firefighter with a slow rate of speech in derogatory tone, looks at the camera and smiles. The student in this situation has demonstrated behaviours that are consistent with the phenomenon widely known as "playing to the camera" whereby the subject's actions are altered because of the dynamic created by the presence of a camera (Zada, 2015). This behavior was observed even though the students have constant exposure to video recording as it is a standard element of HFS.

In scenario 3 a student is performing a surgical technique known as a cricoidectomy. During the preparation for the procedure the student locates the required anatomical landmarks, looks at the instructor running the scenario and says, "I can feel the landmarking but are you going to tell me I can't?" Although the increasing fidelity of the mannequins is allowing for an ever increasing number of parameters to be simulated and modified through microprocessor controlled technology, many human physical findings are still not able to be replicated. This observation implies that the student is so familiar with receiving verbal directions contrary to what they are assessing that they seek out the alternative findings even as they perform procedures.

Significant events are not isolated to student behavior. In scenario 4 the instructor stops a student as they were beginning to prepare to conduct a needle decompression of the chest stating "for the sake of time just describe how you would do it" . This incident illustrates the influence that time and schedules have on HFS simulation. Educational environments necessitate that multiple students require a similar exposure to the HFS scenario. The constraints of time and resources often dictate that schedules be adhered to regardless of what is happening in the HFS.

During scenario 8, the scene is set out of doors to mimic the real life environment of the situation in which the patient fell from a roof top. The ambulance is parked beside the scene as it would be in a real life event. Despite having all of these design and delivery features present, the student consistently pretends (verbalizes) that they have what they need instead of obtaining the required equipment from the ambulance (where it is located in real life). The student then displays signs of frustration when the instructor says "WYSIWYG (What You See Is What You Get), Big Black Truck" (referring to the ambulance) Implying that they need to obtain the equipment they need rather than pretend they have it. Additional context is added to this incident when one considers that these are experienced practitioners who have a minimum of 4000 hours working in the field before they enroll in this graduate program. Obtaining equipment from their vehicle is not a new concept for this group.

Scenario 13 presents an adult male in the emergency room who has suffered burns and a significant inhalation injury as a result of being in a house fire. The patient is initially conscious but is having difficulty breathing. Despite the patient being conscious and moaning, the students do not speak to the mannequin throughout the entire scenario. The instructor, playing the role of the Emergency room physician role models effective communication with the patient but the students do not emulate the behavior. Despite witnessing the communication demonstrated by the instructor the students proceed to care for the patient without ever providing an introduction, an explanation of a procedure or to even ask how the patient was. Actions performed on the simulated patient without any communication with the patient includes the insertion of an oral airway (large plastic tube) into the mouth of the patient while the patient was still conscious. Although neophyte practitioners will often focus on their own actions at the expense of communication with patients not saying one word to a patient is illustrative of how they are perceiving the interaction with the mannequin as it is highly unlikely that even the most anxious and inexperienced student would remain mute in an actual patient interaction.

Lastly, in scenario 20 two students are caring for a 7 year old child named “Jack” with a brief history of asthma. Also in the scenario are two other students, one playing the role of a nurse and one playing the role of Jack’s mother. After interacting with Jack for over 7 minutes the student’s note that Jack begins to deteriorate and he goes on the suffer a respiratory arrest. As the child deteriorates and they have to start CPR on the seven year old child. Despite this significant deterioration in a child that they had been speaking with no change in demeanor is noted. Likewise, no change in vocal tone is noted. During compressions two students smile and giggle as the other students playing the role of the RT wanders back and forth looking for a piece of equipment. As the nurse compresses her child’s chest the “mom” remains calm, often smiling. Throughout the scenario the nurse displays numerous behaviours interpreted as disinterest (standing with hands in pockets, siting cross legged at the bedside table and frequently looking at the floor. The scenario ends when the instructor walks out of the control room and says “that has been way too much fun for us in there watching that” and everybody laughs. Engaging with a child who is relatively well and then deteriorates while in your care is a high stakes, emotionally charged event. The behaviours observed by the students and the faculty in this simulated situation are far from what one would expect if the situation was perceived as real.

4.3.2 Significant events more consistent with patient interaction

In scenario 14, two RT students are caring for Mr. Hubert Jones who has been admitted to hospital with shortness of breath. During their interaction with Mr. Jones, one student leans forward to place herself in a better position to communicate with Mr. Jones. This was one of the few times where it was noted that a student actively employed body positioning to more effectively communicate with the mannequin. Similarly, the other student participating in this scenario was observed placing her hand on the mannequin even though this physical touch was not required to perform a procedure. This type of touch is known as a comfort or non-necessary touch and is recognized as a powerful and effective nonverbal communication technique (Campbell, 2005, p. 292). Demonstrating this communication technique while engaging with a mannequin as one would a human patient raises a significant question. Did these students engage with the mannequin in the manners described above because they perceived themselves as being in a real life event interacting with a real patient or, did they engage in this way for other reasons such as knowing this was an activity that was being assessed and evaluated?

As identified in the analysis of the coded data, the significant events observed also indicate that while there are behaviours occurring in the HFS scenarios that are consistent with a patient interaction, there are many significant events that are not.

Analysis of the data that has emerged from the ethnographic observation of the HFS has revealed that while students participating in HFS demonstrate behaviours that are at times consistent with the behaviours one would expect in a real life situation they frequently demonstrate behaviours that are not consistent with a patient interaction. When the relationship between the fidelity of the simulation and observed behaviours is investigated, the data reveals that fidelity does not consistently influence the student's behavior in the manner that one would expect from either logical reasoning or is often suggested in literature. What then is influencing these behaviours? Exploring what the students were perceiving during HFS scenarios and how those perceptions were informing the actions observed requires that we hear from the students themselves. As such the presentation of the findings of this work will now move to articulate the data that emerged from the post HFS scenario interviews.

4.4 Finding Meaning in Interview Data

To further explore what students experience when they interact with HFS mannequins in simulated environments, the methodology of this work required that I conduct a follow-up interview a student from each of the groups that participated in this study. As described in the methodology chapter and consistent with what Charmaz (2014) describes as "intensive interviewing" (p. 57) interviews were conducted using an informal, conversational approach. During each interview I reviewed various segments of the video recording from the HFS scenarios that the interviewee participated in as a means to assist the participant's recall. Each interview was audio recorded and then transcribed. Analysis of the transcribed interview data provided further insight into the research question as the students articulated the thought processes that influencing their behaviours in the HFS scenarios. Given as many groups participated in similar scenarios data was initially considered collectively and then was further analyzed to explore differences arising from the two distinct participant disciplines.

4.4.1 Initial coding and Themes Emerging in the Interview Data

The students from the various participant groups that volunteered to be interviewed were generally eager to discuss their experiences with HFS. Initiating the interview with an open ended exploratory question such as "Tell me about your experience with high fidelity simulation now that you have been through it. What do you think?" allowed for the conversation to go in multiple directions with the participants providing insights into the thought processes that informed their actions in the HFS they engaged in. Initial coding of the interview data and subsequent focus coding (Charmaz, 2004, P. 57) revealed several themes emerging from the data. The initial codes and the themes that emerged from focused coding is summarized in Table 9.

Table 9

Initial Codes from Interview Data and Emergent Themes arising from Focused Coding

Initial Code	Description	Theme
GMOT	Got more out of it than they thought	Value HFS
LHFS	Like HFS	
PFI	Desire to perform for instructor	Stressors / motivators in HFS
NU	No urgency felt as it is simulation	
SFBW	Stress from being watched by instructor	
SFOS	Stress from other students	
SFPD	Stress from patient deteriorating	
IPMS	HFS improves psychomotor skills	HFS Improves Psychomotor skills
DNPFCE	Does not prepare for clinical environment	Ability of HFS to prepare for real life / clinical practice
PFCE	Prepares for clinical environment	
PFRL	Prepares for real life	
STRL	Similar to real life	
DDH	Realistic design and delivery helpful	Design delivery features helpful
EE	Experienced emotion in HFS	Emotional responses in HFS
LOE	Lack of empathy in HFS	
NERM	No emotional response with mannequin	
NPTSD	No PTSD with HFS	
DNFLT	Did not feel like a test	HFS feels like a test
PTBT	Prefer to be a test	
TNRL	Test not real life	
AOM	Non distinct appearance of mannequin	Appearance of the mannequin detracts from realism and
FFM	Feedback from mannequin	
LOM	Limitation of mannequin	

IWM	Interaction with mannequin non-effective	impairs ability to interpret what is happening
APLRP	Attempts to perceive mannequin as real	HFS mannequins and simulated environments are not real
PIR	Pretend it is real	
LVG	HFS like a video game	
MNLRP	Mannequin not like real patient	
MRTVG	More realistic than video games	
NRL	Not real life	
NTT	No therapeutic touch	
RPNHFS	Remembers patients but not HFS	
DRC	Don't replace clinical	HFS does not compare with clinical and field experiences
IPENS	Interprofessional education not the same as in clinical setting	
NFHI	Need for human interaction	
ASA	All scenarios arrest	Issues that could be addressed
ELFS	Experience with LFS impairs experience with HFS	
IF	Initial Frustration	
LVH	Low Vs. High Fidelity	
TIDFE	Technology issues detract from experience	

Although table 9 provides an overview of the diversity of the experiences described by the participants, richer meaning can be found in the actual words of the students. What follows are examples of what the students articulated as they shared with me what they experienced during their engagement in HFS. I will first present what I refer to as general themes: perceived value, stressors and motivators. Next I will present the data that reflects what the student participants found helpful about HFS: improved psychomotor skill performance, the design and delivery elements that enhanced fidelity, and in many cases (but not all) the ability of HFS to prepare students for clinical or field placement. This will be followed by the data that will help illuminate the thought processes the students experienced while engaged in the HFS scenarios: emotional responses experienced in HFS, HFS feeling like a test, impaired ability to interpret what is happening due to the appearance of the mannequin, and the understanding that the mannequin and the simulation is not real. I will then present data that reflects the participants opinion that HFS does not compare with clinical and field experiences

Individual participant comments are identified with a participant letter. When dialogue between me and the participants is presented, my comments are indicated with an "M" and the students' comments are identified with an "S". In the presentation of interview data participants may be referred to as "he" or "she". The use of these pronouns was randomly assigned and does not imply the gender of the participant.

4.4.1.1 Enjoyment and Value of the HFS experience.

As the participants described their personal involvement with HFS one of the prevalent themes to emerge was that the students appreciated and valued their HFS experiences.

I think this is an amazing opportunity to use these high fidelity mannequins.
I would not want to go back to actors (Participant C)

I think it has been a great experience.
…with the high fidelity mannequins, some of the new ones they have downstairs, you are actually putting the leads on the red dots and attaching them in the appropriate places and then from there you are looking at your monitor, so I think from that, it has been a huge benefit. (Participant E)

I found it was great. It was great to put down the textbooks and have that hands on approach.
Well it was a great experience. You know, we all wish that we had had more time doing it and more of it. (Participant F)

I thought it was a good experience and like I said earlier, it would have been better to have more. (Participant J)

4.4.1.2 Stressors and Motivators in HFS

Many of the students interviewed expressed that they felt stress during the HFS simulation experience. Not surprisingly these stressors arose from multiple sources. However, a number of students communicated that a primary motivator was to not disappoint or look foolish to their instructor. Interestingly, this sentiment was expressed in both the inexperienced RT group and the more experienced ACP group.

I couldn't help from being incredibly nervous, and was still like that in the clinical setting sometimes, but it was just the idea that yes my teachers are watching, I am being videotaped, my classmates are evaluating my performance or they are waiting for me to initiate something that can spur something in them. (Participant D)

I remember it because I see instructor X over there filming, so there is an added stress there because he knows his stuff and he is expecting me to kind of do well. (Participant C)

I think it (anxiety) was more being afraid of doing something wrong and then your teachers think that you don't know how to do it (Participant H).

You don't want to go in there and look like a fool even though there is no marker or mark, you still want to present yourself as high as you can or as professional as you can even though we had no experience of what really we should be acting like. Yeah it felt like you were being evaluated. (Participant L)

I remember feeling a bit sick before doing this because I was so nervous, but beforehand I remember thinking it was more about the skill but now when I look back at it, I don't think the skills were a big part of it for me. I think the most thing I got out of it was learning to work when you are nervous. (Participant H)

At the time I had no idea what had actually happened as I had never been in that situation for real, so I am just thinking that it is just more to please instructor X. To make him think that we know what we are doing. (Participant H)

4.4.1.3 Improved Ability to Perform Psychomotor Skills

Exploring the factors that influenced their positive perception of HFS, many of the participants expressed that they found the HFS scenarios provided the opportunity to develop and hone their performance of skill sets that require a level of manual dexterity and neuromuscular coordination. These activities are known as psychomotor skills (Oermann, 1990).

The simulation mannequins are great for doing skills like getting your tubes, IV's and IO's and all that kind of stuff. (Participant B)

I have done it (intubation) so many times on the mannequin, you are a little more prepared looking at that, when you are looking down the real person's throat. (Participant B)

I think they are great because I feel I have really honed in on my skills for cardiac arrest. (Participant C)

I think they (mannequins) have been a great tool in working and learning through procedures and your actual skills such as getting an IO,(interosseous access) being able to landmark and everything else, because I mean particularly with IO's you are not going to be able to practice on real people. (Participant E)

I probably intubated that Mannequin, that was in there, probably 1000 times just to do it over and over again and then you can start to work on the stuff the doctors have such as caring about the patients, not just this plastic head, (Participant G).

4.4.1.4 *A*bility of HFS to Prepare for Clinical Practice

Another prevalent theme to emerge in the interview data particularly from the RT group was the ability of HFS to help prepare them for placement in a hospital clinical setting. As one student expressed, she had never seen an intensive care unit or hospital and reflecting on her HFS experience allowed her to appreciate how much it had prepared her to enter the hospital environment.

I am glad I did it because for myself, and I have said this throughout my clinical year as well, I have been fortunate in that I haven't had a lot of experience in a hospital period even visiting family so I am fortunate that way, but at the same time it kind of leads me down the path where I am not familiar with certain equipment. Even moving the bed was something that I wasn't even aware of how to do. So it was great in that sense where I could familiarize myself. That is what a hospital looks like. (Participant F)

I had really never been in a hospital before. I don't watch the hospital shows or anything so I really didn't have an idea of what the clinical setting was actually like. (Participant G)

Like I didn't feel like this scenario was good because it taught me how to deep suction a patient. It was more how to work with the monitor blinking and the alarms going and being nervous and maybe like learning the things that you would say to a patient more so than the skills, so maybe that is what SIM labs are about. (Participant H)

But it helps you, as I said before going into clinic. There is nothing more intimidating than walking into a hospital the first time and not knowing what is to be expected and not knowing what your role is. (Participant I)

However some of the participants from the more clinically experienced ACP group also found that HFS helped to prepare them for clinical practice.

And it is good because you can get out there, you can train in the classroom in a controlled environment and then you can go in the real world and see what it is like and then you can kind of relate the two. To be honest, I mean this is the best experience I have ever had because the facilities are fantastic, you have the monitors, you have all this equipment, you have the pumps there so you are in that mindset like this is real (Participant C).

4.4.1.5 Impact of Design and Delivery Features

In the analysis of the video data, many HFS scenarios explored in this work contained a number of design and delivery features that were more aligned with what would be expected in real life and therefore contributed to enhancing the fidelity of the scenario. Although video data analysis indicated that higher fidelity design and delivery features was not consistently related to a greater occurrence of student behaviours more consistent with a patient interaction (see 4.2.5), numerous students interviewed commented on the benefits they perceived from higher fidelity design and delivery features that more accurately reflected their work environment.

The following is an exert of the exchange between myself (M) and a student (S) as I explored his perceptions on the impact of performing a HFS scenario in the back of an ambulance (which is more like their actual work space) as opposed to performing the HFS scenario in a simulated in hospital environment.

M: What is the impact of having all this equipment around? Has it enhanced the experience for you?
S: No it totally takes away from the paramedic feeling. In the real world we don't have a monitor there and we don't have those kinds of beds.
M: So it isn't helpful for you?
S: No
M: Let fast forward here to Semester two and now you are in the truck. Different?
S: Well I have a smile on my face.
M: What's the difference here? I mean you are in the truck obviously.
S: That is my work space. This is at the point where I am getting more comfortable with scenarios anyway. But I found, and we have only done a couple of calls in the ambulance, but it is outside and the patient isn't actually laying on a bed. I found working in an ambulance is a lot more fun and a lot more calming than working in a hospital.
M: Are you thinking this is more a real patient or are you thinking it's still a mannequin?
S: You know in this scenario I was only working the airway, but I find working in my work space, even when we do calls outside and we take the mannequins outside, it is easier to visualize that it is a real person as opposed to them in a hospital bed with their mouth open and staring off into the distance.

Another participant offered an insightful design and delivery suggestion to improve the fidelity of HFS. She noted that she would have found it more helpful in the HFS if a selection of equipment was available, not just the particular equipment needed for that scenario.

S: Maybe if you put out more equipment, just to confuse people a little bit more, and I am sure they won't appreciate me mentioning that, because I think for that first one and the one I did with the nurses, there is kind of just a limited amount of stuff that you need for that scenario. There is a couple of different ones, but…
M: So more equipment to choose from, like more in the clinical sense, you open up the drawer and there is more stuff there.
S: Yeah not a desk with just exactly what you need to do the scenario. (Participant A)

Participant H noted how the fidelity of the design and delivery features create a sense of urgency.

S: Yeah it is good especially…see the flashing on the monitor, and the noise? That is really good because we never had that in lab and to work with an alarm in the background is a lot different than to work with just your friends talking.
M: Now why is that different?....... What effect is that having on you here?
S: To me it telling me to work faster because like this person needs help quicker. I know in this simulation when things start to alarm, I would get more panicked. (Participant H)

Participant H also presented an interesting perspective while we were discussing the impact of design and delivery elements of HFS when he indicated that the ability of the design and delivery fidelity had more impact than the ability of the HFS to develop her psychomotor skills.

Like I said, I do think they were really good for learning to work when you are nervous and working through your nervousness, because you have to do that a lot. More so than the skill. Like I didn't feel like this scenario was good because it taught me how to deep suction a patient. It was more how to work with the monitor blinking and the alarms going and being nervous and maybe like learning the things that you would say to a patient more so than the skills, so maybe that is what SIM labs are about. (Participant H)

4.4.1.6 Emotional Responses Experienced in HFS

One of my initial suppositions in creating the conceptual framework for this inquiry was that health care is dependent upon provider-patient interaction. As many patient – provider interactions can be emotional events such as a patient's condition deteriorating while in your care, having to cause pain to perform a procedure, or a patient death, I was interested to better understand what, if any, emotional responses students experienced when they engaged in HFS scenarios.

Participant H was one the few participants interviewed that identified that she felt emotion during HFS scenarios.

M: He starts to cough and you quickly pull it (suction catheter) out. What are your thoughts there, even watching it now? Do you get the sense that you are actually causing him discomfort? From an emotional sense did you feel that you were causing this person discomfort?
S: Yeah and that would be the same reaction I would have with a real patient too. (Participant H)

More commonly, the participants expressed that they did not experience emotion or have a sense of empathy for the mannequins in HFS.

There is no emotional response on the mannequin, absolutely. (Participant B)

I still would have a hard time actually caring as much. Actually wanting to rub their shoulders and saying it is going to be okay, or hold their hand or whatever the case. I mean you do it but you are not really feeling it. You know this is what you are supposed to do. It is just so much different actually having a real person who is actually having a crisis. (Participant B)

You know you aren't hurting the mannequins…..you are not worried about breaking their teeth, you are not worried about cutting their airway, doing injections you are not worried about the poke. Whereas with real people, you are always concerned. (Participant A)

The mannequin is a mannequin. The situation is over, what I am thinking about is how my performance was, versus, oh sorry we didn't save him. (Participant F)

I have never associated it (HFS) to an empathetic response from the patient (mannequin) outcome. It has just been, well I screwed that up. We are supposed to be learning in this and it is a mannequin and that is alright. Better not do this in practice, blah blah blah but personally I don't think I have ever consciously tied an emotion to poor patient (mannequin) outcome or any added stress. (Participant E)

…We just started our OR placements, and it is a lot more nerve racking sticking that metal blade in somebody's mouth than it is sticking it in a mannequin's mouth. (Participant A)

The emotional ties are minimal and I find that with the mannequins you can very easily disassociate yourself from those after the scenario is done and they you are just more so concentrating or stressed by your own performance as opposed to, well because of my actions this patient is now a paraplegic or because of my actions, this patient is dead. (Participant E)

4.4.1.7 HFS Feels Like a Test

Although the scenarios included in this inquiry were part of regular class activity and did not form any part of a test that contributed to a student's grade, a common perception from the participant's interviewed was that HFS felt like a test. Responding to my question about how the presence of an evaluator (faculty member) affected their experience Participant G responded,

It kinda made it feel more like a test than a real scenario. (Participant G)

Exploring what a participant was experiencing when they entered a HFS scenario produced the following data:

M: So you have been called in to see Mr. Jones in this case, and what are your thoughts when you walk in? What is your head space like? Are you thinking you are in a patient's room or is it more like a test?
S: More like test, definitely (Participant H)

Participant C noted that she performed actions in a scenario for the primary reason of getting the check mark on the evaluation form not because they felt they were working with an actual patient.

I hit the button and I got that mark that I showed empathy or something like that. (Participant C)

Participant D articulated that they felt more stress in HFS than they did working with actual patients due to the feeling of being evaluated.

I think working with a real patient you don't feel judged.

Like you are stressed because you are put in a situation (HFS) where all eyes were on you, but you are being tested. It is not all eyes are on you when you are doing your job. It is the second guessing yourself because now you are being marked. (Participant D)

Participant I shared some very honest insights when we were exploring the phenomena of HFS being perceived as a test and what influence that had on behavior. During our interview we were reviewing the video recording of his group's scenario and when I asked him what prompted him to perform an action before there was really a reason to do so. He acknowledged that he had heard from other students that had previously completed the HFS scenario that the mannequin required intubation so he was getting ready.

M: I wonder why you did that?
S: Cause I wanted to make room for myself at the head of the bed.
M: "I have heard from the other students that he needs to be intubated so I need to get around to do that?"
S: Exactly. (Participant I)

Perceiving HFS as a test informed many students to perceive HFS as less real life and caused them to engage in "before test activities" such as Participant I asking other students what was "on the test". Paradoxically, Participant L presented an alternative lens on the influence of perceiving HFS as test when she expressed that she wished she and her classmates had perceived HFS more like a test as they would have taken HFS more seriously.

M: Would an actual evaluation have made any difference at all? Like if there was grade assigned to this?
S: It would because then you would have been more prepped.
M: That's interesting.
S: I would have prepped myself a lot more than what I did. And I think mine was the day after St. Patrick's Day and a lot of my other classmates were out the night before. I personally wasn't. But yeah I would have prepped myself more.
M: That's interesting. And did the fact that there wasn't an evaluation, I am hearing from that then that maybe people didn't put as much into it.
S: Didn't take it as seriously.
M: Didn't take it as seriously. Okay

4.4.1.8 Impact of the Non-Lifelike Appearance of the Mannequin

As noted previously, the computer enhanced mannequins utilized in HFS have the ability to simulate numerous lifelike actions. These mannequins can produce blood pressures that can be assessed, chest sounds that can be auscultated, eyes that blink, and even broadcast speech. However, despite these and numerous other notable life like qualities that can be replicated by HFS mannequins, many students noted that the non-changing, "plastic" appearance of the mannequin had a significant impact on how they perceived HFS simulation. Participant A relates the appearance of the HFS mannequin and how that compares to a real patient for him.

S: It feels more realistic to some extent but then to other extents, because and this goes back to like working with real people and then working with the mannequins and with *real people you can see when somebody is lethargic and you can see when somebody is grey and everything like that and then when you walk in to these mannequins, they just sit there with a blank stare on their face.*

M: They look the same.

S: Exactly, so you don't have that sense of urgency initially that you would have with someone who is coughing. Like we had a call on the weekend that was just coughing, like flash pulmonary edema. You can't simulate that with a mannequin. You don't have sense of urgency with the patient (mannequin) that you would have. (Participant A)

The mannequins are all just sitting here in this prone position but they are not really moving and you are getting chest rise (or not) but you are not really getting the sense of urgency into what is going on. (Participant B).

You can have a mannequin going 36 resps per minute but there is just no emotion in the face. You are not seeing the wide eyes or whatever else because they can't and it is scary cause they can't catch their breath, right? You might hear it in the voice of the speakers coming through but you just don't see it in the mannequin. (Participant E)

When asked to compare a clinical experience to HFS, the first thing noted by Participant F was the inability to detect distress by looking at the mannequin.

Well I really like how with real people, you can actually….they have some cyanosis or whatever and they are groaning and whatever, but when you are actually in front of a person, you can see the difference, when they need help, they need it.

After acknowledging that the HFS mannequin in the video we are watching does not appear in distress Participant F comments:

No he is just sitting there and not really doing anything. (Participant F)

This non lifelike appearance of the mannequin was noted by several of the students as a significant source of frustration.

It is just frustrating when you can't find what you are supposed to find or things don't match up (Participant A)

While jointly viewing the video of her HFS, Participant I acknowledged that she did not appreciate that the simulated patient in her care was deteriorating. She explained that at the point in the program when she participated in HFS that she had not seen a patient in distress and as the HFS mannequin did not change in appearance she did not realize that the patient's condition had worsened.

Now if I was doing a SIM I would be more comfortable with that because I could actually visualize someone going through this. Before I was in the clinic, I couldn't picture what he would like. But yes it is hard for you guys to SIM. Obviously you can't make someone diaphoretic and what not. (Participant I)

4.4.1.9 The HFS Mannequin is Not Real

A large body of evidence emerges from the interview data when I explored with the participants the thought processes that influenced their behaviours that were noted in the video data. Although the participants readily articulate the benefits they experienced from engaging in HFS scenarios, with few exceptions they do not perceive the HFS mannequins or the scenarios as real situations.

M: Is there some notion that this is a real patient?
S: No. It is not the same. Not the same as actually, because yes you can talk through these things and make them sound like they are talking, but it is not the same. (Participant A)

So I think it is getting your head wrapped around the fact that they are never going to be real people is one of the big things I took out of it and that is what helped me progress, so just kind of deal with what you see and if you have to see something else, somebody needs to tell you. (Participant A)

You will never get that human interaction that you will have with a distressed patient on an emergency call. Or even talking to a person who just needs to talk. (Participant A)

But as I said before with the live patient you can actually get a sense of what is going on a little bit more with them acting and telling you a bit more as opposed to the mannequin, where you look to the mannequin for an answer, then your teacher says it to you and at the same time you ask the question, the speaker on the mannequin talks to you. So it is kind of hard to put yourself in like this is the real situation when you are working with those things. (Participant B)

Rubber doll kind of thing. (Participant B)

Like when I rolled over his hand, I didn't really think anything of it, but I mean I think with a real patient I would be a lot more cautious and also with a real patient if I move his arm it will actually move as opposed to rigidly sticking out there, but no I don't feel like they are real people. (Participant B)

Well yeah you know that the mannequins are not real. (Participant C)

When asked if he had anything else to add at the end of his interview, Participant C inferred that for experienced practitioners, working with HFS is so different than working with an actual patient that we should not penalize a student if they don't do well until they figure out how to work with the HFS mannequins.

I mean don't write off someone right at the start because they are not doing good patient care, because it is not a real patient. But eventually you get into that routine (of working with the mannequins) *(Participant C)*

Talking to the mannequin helps cause it can give you a response, but it is hard because you are never going to simulate a live person or a live situation anywhere. (Participant D)

While some in the literature suggest that we are getting closer to HFS replicating a real patients, Participant D presents a differing opinion later in his interview when I asked him what make a HFS mannequin not like a patient for him and after a long list of fidelity issues concluded:

I think that is night and day. (Participant D)

But even with that,(higher design and delivery fidelity) going in you know it's not real. So I don't know if it will ever be real to me. (Participant D)

Participant H articulates the difference in his thought process between a HFS simulation and a clinical situation.

M: Are you thinking that Leon is having that (pain)
S: No is more like, okay what do they want us to do. What adjuncts or what avenues do they want us to identify that we need to go down. What are the important symptoms so that we can do what needs to be done, but that is what they want to see us do.
M: Right, and if this was a clinical situation where Leon was there and you walked in and you had this surgeon who is wondering about how to manage his airway, how would that differ?
S: I think you have a different feeling because you still need to go through all the same thought processes but in the back of your mind or in the front of your mind, you are like Holy Crap there is someone who is potentially dying in front of me. Like what do I do? (Participant H)

Participant J describes the mannequin as a "fake patient" several times during our interview.

Like if it was an actual person, I wouldn't have them laying back like that. I would have them sitting completely up, which we were trying to do but this fake patient was hard to work with. (Participant J)

I am looking at my classmates and now all of a sudden that is the mother of this patient. So it is not really true, its not real. (Participant L)

As reflected in the data above, the perception almost unanimously expressed by the participants was that they did not perceive HFS as a real event. While Participant F also acknowledges that the HFS mannequin is not a real patient, for him the ability of the mannequin to speak makes it more lifelike.

M: (Do) you think this is patient talking to me, or are you still thinking it is a mannequin?
S: little bit of both.
M: Okay, can you explain that a little bit.
S: Well I know going into the scenario that it is just a high fidelity simulation, so I know that I am not working with real people, but at the same time it takes it to another level in that it responds to you, you can communicate.

4.4.1.10 HFS Does Not Compare with Clinical and Field Experiences

One of the factors that prompted this work was the emerging and increasing trend in Health Science education to replace time spent in traditional clinical settings engaging with patients with time spent in simulated environments engaging with HFS mannequins. The previous section of findings indicates that students do not perceive HFS mannequins or simulations as real but, what impact does this perception have on the student's ability to perceive HFS as a substitute for experience in clinical and field settings? Having a group of students that had experienced both HFS scenarios as well as clinical and field placements provide the opportunity to explore this question.

S: …it is nice to practice on the mannequins and then going to a car accident where a person is boarded and collared and we need to intubate them is not the same.
M: What is the big difference?
S: It is just a big step going from the mentality of a mannequin to a person (Participant A)

I can see patient care failing without human interaction. That is my big piece on that. (Participant A)

I would still want the clinical experience. Nothing compares to real life. This comes very close to it but nothing will prepare you for real life. (Participant F)

While on the one hand Participant F expressed his appreciation for HFS on the other hand he was annoyed to be removed from a clinical experience to engage in HFS.

Well it (HFS) was a great experience. You know, we all wish that we had had more time doing it and more of it. Can I tell you one thing? I don't know if this really relates to you or not, but during our clinical rotation, we were actually taken out of the hospital to come back and do one of these. I didn't like that. I was actually in the clinic and involved with real patients and other allied health professionals. Yeah that was just one part I had a hard time wrapping my head around. Why are you removing me from the real thing to come back and do this?(Participant F)

4.4.2 Summary of Findings Emerging from Interview data

The research question underpinning this work asks what health science students experience when they engage with HFS mannequins in simulated environments. Observing and analyzing the actions of students engaged in HFS assisted with our understanding of what was occurring during HFS but did not shed light on ***why*** it was occurring. Conducting one on one interviews with participants from each HFS group provided the vehicle to better understand the student's thought process that were informing their behavior in HFS and afforded the additional data required to further address the research question.

Interviews with the students revealed that although some experienced initial challenges they genuinely appreciated their HFS experience with some students expressing that after having been in clinical environments that they got more out of their HFS experience than they initially thought. A major motivator and potential stressor for many students in HFS was the desire to perform for their instructor or fear of appearing that they did not know what they were doing. The ability to develop and hone psychomotor skills was identified as the significant benefit of HFS. Although some students disagreed, there was an opinion expressed that HFS helped students prepare for clinical or field practice situations. While analysis of the video data revealed that enhanced fidelity of design and delivery features of HFS scenarios did not consistently relate to behaviours that were more consistent with a patient interaction, when interviewed, students expressed that design and delivery features aligned with real life enhanced their experience in HFS and helped them to perceive the experience as more lifelike. When asked if the challenging situations they experienced with HFS mannequins (for example a death) resulted in an emotional response, the general opinion expressed was that HFS experiences did not cause the students to experience emotion.

HFS scenarios that were serving as an actual test of students' ability were purposely eliminated from this inquiry as an element of the methodological design. Regardless of the fact that none of the scenarios included in this work served as a test, a common perception expressed was that for the students in this study, HFS was a test and this perception influenced their behavior.

While technology has significantly enhanced the fidelity of the mannequins utilized to replicate real life in simulated environments, a significant influence on the students' ability to perceive the mannequin as real was the plastic, unchanging appearance of the mannequin. The students expressed that the mannequin looked the same if they were well or if they were on the verge of arrest.

The students interviewed this study clearly articulated that they do not perceive the mannequins as real and do not see simulation as a comparator to clinical or field environments.

In the next chapter I will further discuss the relationship of the video data and interview data findings and how these finding address the research question. I will also explore the limitations of this study and the potential application of the findings of this study to health science education.

Chapter 5

5 Discussion

The impetus for this work arose from the need to question the expanding health science education practice of replacing traditional educational experiences in which students interact with patients in clinical settings with experiences that see students engaging with computer driven mannequins in simulated environments. Utilizing a lens shaped from first hand experiences as a severely injured patient, a critical care clinician and a long standing educator of health science students, this qualitative inquiry explored what health science students experience when they engage with HFS mannequins in a simulated environment.

An ethnographic methodology was employed to determine *what* was occurring as students engaged in HFS simulations. Participant interviews were conducted to explore *why* students demonstrated what would at first brush appear to be conflicted actions during HFS. Data analysis was dependent upon interpretations emerging from my viewpoint.

5.1 What incidents occurred

Analysis of video data revealed the emergence of two major categories of incidents in the HFS scenarios studied, those incidents that were more consistent with a patient interaction and those incidents that were less consistent with a patient interaction. It was identified that incidents arose from principally two sources, student actions and the design and delivery features of the simulation. Although detailed analysis of the relationships between the incident categories and sources of incidents did not reveal consistent or predicable patterns, it was readily evident that the participants frequently performed activities in HFS that would not be expected if the participants were engaging in the provision of care with actual patients.

5.2 The Need to Explore Why incidents Occurred

Video data revealed what was happening in HFS scenarios. However, this only partially informs the research question that was intended to better understand what students experience in HFS. To arrive at an enhanced understanding of what students experience in HFS requires continued exploration into *why* the students exhibited the behaviours that were observed in this work. Why did students rarely touch the HFS mannequins? Why did they giggle at inappropriate times during HFS scenarios? Why did they ignore comments from the mannequin? Why at times did they talk to the mannequins and yet at others address the mannequin and look at their instructor? Interview data illustrated that several thought processes were informing the student's activities in HFS, these included: a desire to perform for their instructor, perceiving the situation as a test, enjoyment of the experience and a common understanding that neither the situation nor mannequin was real. Furthering this qualitative analysis to better answer the *why* questions requires that I now progress to identify the relationships between the *what* (video data) and the *why* (interview data) or in other words, theorize these findings.

5.3 Progressing from Analysis to Theory

> Theories try to answer questions. Theories offer accounts for what happens, how it ensues and may aim to account for why it happened. Theorizing consists of the actions involved in constructing these accounts. Addressing *why* questions about observed actions often raises existential issues such as those of meaning and moral value. (Charmaz, 2014, p. 228)

A constructivist grounded theory approach was utilized to progress from analysis to the derivation of a theory to explain findings which emerged in the data as "grounded theory has a long history of raising and answering analytic *why* questions" (Charmaz, pg. 228, 2014). In addition to being a process that is well positioned to addressing the *why* questions, grounded theory also aligns with this work as it assumes: construction of data through interaction, that the researcher constructs categories and that the observer's values priorities and positions affect views (Chamaz, 2014, p. 236).

The trend to replace clinical hours with simulation continues to expand with major journals and regulatory bodies supporting this practice (Hayden, Smiley, Alexander, Kardong-Edgen, Jeffries, 2014). Hayden et al. (2014) argue that at least half of clinical hours can be replaced and graduates are "ready for clinical practice" (p. S3). If half of traditional clinical hours can be replaced by HFS and the performance outcome for the student remains unchanged, this implies that there are significant similarities between HFS and patient situations. Furthering this logically grounded argument it follows then that if the HFS situation and the patient situation were similar and were being perceived by students as being similar then the student's actions should be similar in both environments. However, this is not what was revealed in this study as the participants engaged in HFS were frequently observed to demonstrate behaviours that were not consistent with a patient interaction. What then explains this discrepancy? Although research and writing is not intended to be neutral work, (Charmaz, 2014) I was reticent to first land on a critique of Hayden et al.'s investigation but rather looked for an alternative theory to explain the incongruity.

High fidelity simulation is just that, simulation. When I enter the high fidelity simulation environment I inherently know that the event unfolding is a simulation of a real life and is not real. I also know that although the patient may be talking and may look like it is breathing, it is not real either. When interviewed, the participants shared that they too do not perceive the plastic, microprocessor driven mannequin as a real patient. The ability to distinguish between real and simulated environments is not unique to HFS, if we retrace our steps back to the seniors playing the interactive video bowling game at the beginning of this paper although they were having fun knocking down virtual pins on a screen they also would have been able to articulate that they were aware that they were in a simulation and not actually bowling.

When the actions of students engaging in HFS are related to what they expressed during their interviews, the theoretical explanation that emerges to explain the observed incidents is that the student demonstrated behaviours that were not consistent with a patient interaction because they did not perceive they were interacting with a patient. They did not conduct themselves like they would in real life because it wasn't real life.

At first glance this theorization that students don't act like simulations are real because simulation isn't real appears far too simplistic to explain the complex interactions that occur in HFS. However, when contemplated and viewed in the context of an academy that frequently assigns a "real life" language to HFS (Edelson, 2011; Knudson, 2013; Isdseneberg, 2005; Kopp, 2012; Rickets, 2011; McGaghie, Issenberg, Barsuk and Wayne, 2014; Oberleitner and Broussard, 2014) I would argue a deeper meaning emerges from this simplistic theory. Like the Yogi Berra quote, "You can observe a lot by watching" (Berra, 2008) the more I think about it, the greater the understanding that emerges. The issue isn't that HFS cannot replicate real life, the issue is that the academy continues its attempts to make it replicate real life.

5.4 Implications

Although the benefits of HFS are diverse, well documented and supported in this work, the data in this study also suggests that health science students do not experience HFS simulation with a mannequin as they would a real life interaction with a patient. Yet, as access to traditional clinical learning environments continues to be threatened (McNeils, Fonacier, McDonald & Ironside, 2011), educational institutions are increasing their reliance on HFS to replace student - patient interactions (Hayden et al., 2014). In other words, substituting real life clinical learning experiences is not a best practice but rather a default practice. The findings of this work question if it is an adequate default practice. My theorization that students do not experience HFS as they would a real life patient interaction because HFS is not real invokes the question, what then can be effectively learned and experienced with HFS and what requires an actual patient situation? When the findings of this work are considered are through the lens of social interaction an additional question emerges. If social interaction underpins health care as Ben-Sira (1976) articulated, can students develop the social interaction skills necessary to deliver effective health care when their care provider – patient interactions have occurred primarily with HFS mannequins and not real people?

While these weighty questions extend beyond the intent of this inquiry they serve to shed light on the potential ramifications of replacing clinical learning experiences with HFS and illustrate the need for additional research exploring these issues.

5.5 Limitations

There were several study limitations. Although the research question asked what do health science students experience when they interact with high fidelity simulation mannequins in simulated environments, realities of resource and time constraints necessitated that the scope of the study be limited to two distinct health science disciplines at one educational institution. This less than ideal breath limited the diversity of data obtained. The methodology employed purposely intended to have interviews conducted after students had experienced real life patient interactions. While this allowed for students to compare their HFS experiences to their clinical experiences as intended, delays created by scheduling challenges, out of town field experiences and other logistical issues resulted in a time lag of several months between the HFS scenario and the occurrence of the interview. Reviewing the video data during the interview assisted many participants with their recall of the HFS however, some participants commented that it was difficult to recall specific details given the passage of time from HFS scenario to interview.

5.6 Implications for Future Research

Despite the scope limitations of this work, the findings support the understanding that students do not perceive HFS as a real event. While this understanding serves to call the practice of replacing real life clinical situations with simulated interactions into question, the potentially more significant impact of this work is to evoke additional questions regarding health science education. If reality requires that access to clinical environments must be judiciously allocated, then what elements of health science education absolutely require a patient interaction for students to achieve expected learning outcomes? As educators strive to enhance curriculum delivery, further avenues for additional research will be to explore ways in which HFS can be positioned as a *best* practice rather than a *default* practice when clinical learning spaces are unavailable. The inconclusive findings related to the impact of design and delivery elements also evoke an additional research opportunity as there would be benefit in having a better understanding of what design and delivery techniques enhance HFS and facilitate the greatest transition of learning into clinical practice. This information would be helpful as health science education institutions question where to focus resources. Is there a benefit to spending limited capital dollars on enhancements to HFS mannequins or is a greater benefit derived from investing in enhanced simulated spaces that more closely replicate clinical environments?

Given the proliferation of HFS in health science education it is essential that the work exploring the impact of HFS continues as a means to ensure that the highest quality experiences are available for future practitioners.

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Appendix A - Ethics Approvals

FANSHAWE
COLLEGE
RESEARCH
ETHICS BOARD

Fanshawe College Research Ethics Review Board
Approval Notification of Proposed Research

Protocol #10-09-28-1 – M. Hunter

Involving Staff/Students and/or facilities at Fanshawe College

Principal Researcher(s):	**Mark Hunter**
Research Protocol Title:	**High Fidelity Simulation: Panacea or Potential Problem**
Research Project Start Date:	**October 2010**
Expected date of termination:	**April 2011**
Documents Reviewed:	**Completed Protocol**

The Research Ethics Board has completed its Delegated Review of the above Research Proposal and **Conditionally Approves** the Project.

Comments and Conditions:

Dear Mr. Hunter,
Your research project #10-09-28-1 was reviewed by the Research Ethics Board on October 14, 2010.

It is assumed from the Protocol that the interviews are done individually, not in a group; if it is the latter, there needs to be a confidentiality agreement which can be obtained from Dr. Roger Fisher.

Please note that the REB requires that you adhere to the protocol reviewed and approved by the REB. The REB must approve any modifications to the protocol before they can be implemented.

Researchers must report to the Fanshawe REB:
a) any changes which increase the risk to the participants;
b) any changes which significantly affect the conduct of the study
c) all adverse and/or unexpected experiences in the course of carrying out the study;
d) any new information which may adversely affect the safety of the subjects or the conduct of the study.

Researchers must submit a Progress Report annually for all ongoing research projects. In addition, researchers must submit a final report at the conclusion of the project.

ETHICS APPROVAL DOES NOT CONSTITUTE PERMISSION TO CONDUCT THE RESEARCH, AND APPROVAL FOR CONDUCTING THE PROJECT MUST BE OBTAINED FROM THE DEAN OF THE FACULTY IN WHOSE AREA THE RESEARCH WILL TAKE PLACE, OR IN THE CASE OF COLLEGE WIDE SURVEYS THE OFFICE OF INSTITUTIONAL RESEARCH AND PLANNING.

Members of the FCREB who are named as investigators in research studies, or declare a conflict of interest, do not participate in discussion related to, nor vote on, such studies when they are presented to the FCREB.

Oct 20/10

Mr. Otto Rosenkrantz
Chair, REB
Fanshawe College

Date

APPROVAL OF MEd THESIS PROPOSAL **FORM A**

If the proposed research does not involve human subjects or the direct use of their written records, video-tapes, recordings, tests, etc., this signature form, along with ONE copy of the research proposal should be delivered directly to the Graduate Programs & Research Office for final approval.	**If the proposed research involves human subjects, this signature form, along with ONE copy of the research proposal and FOUR copies of the Ethical Review Form must be submitted to the Graduate Programs & Research Office for final approval.**

IT IS THE STUDENT'S RESPONSIBILITY TO PROVIDE A COPY OF THE RESEARCH PROPOSAL (INCLUDING REVISIONS) TO THE THESIS SUPERVISOR AND ALL MEMBERS OF THE ADVISORY COMMITTEE.

Student's Name: Mark Hunter ID # [redacted]

Field of Study: Curriculum

TITLE OF THESIS: High Fidelity Simulation: Panacea or Potential Problem

DOES THIS RESEARCH INVOLVE THE USE OF HUMAN SUBJECTS: YES ☑ NO ☐

Name of Thesis Supervisor: Dr. Sandy Deluca

Name(s) of Members of the Thesis Advisory Committee: Dr. Kathy Hibbert

APPROVAL SIGNATURES:

Graduate Student: [redacted]

Thesis Supervisor:

Advisory Committee: (at least one)

Ethical Review Clearance:

Review #: 0909-1 Date: Sept 20/10.

Associate Dean GPR: [redacted] Date: 20/09/2010

A STUDENT MAY PROCEED WITH RESEARCH WHEN A COPY OF THIS FORM CONTAINING ALL APPROVAL SIGNATURES HAS BEEN RECEIVED.

A COPY OF THIS PROPOSAL MAY BE MADE PUBLIC AND KEPT ON A TWO-HOUR RESERVE IN THE FACULTY OF EDUCATION LIBRARY.

Western Education

WESTERN UNIVERSITY
FACULTY OF EDUCATION
USE OF HUMAN SUBJECTS - ETHICS APPROVAL NOTICE

Review Number:	0909-1
Principal Investigator:	Sandy DeLuca
Student Name:	Mark Hunter
Title:	*High Fidelity Simulation: Panacea or Potential Problem?*
Expiry Date:	July 31, 2012
Type:	M.Ed. Thesis
Ethics Approval Date:	May 1, 2012
Revision #:	5
Documents Reviewed & Approved:	Revised Study End Date

This is to notify you that the Faculty of Education Sub-Research Ethics Board (REB), which operates under the authority of the Western University Research Ethics Board for Non-Medical Research Involving Human Subjects, according to the Tri-Council Policy Statement and the applicable laws and regulations of Ontario has granted approval to the above named research study on the date noted above. The approval shall remain valid until the expiry date noted above assuming timely and acceptable responses to the REB's periodic requests for surveillance and monitoring information.

During the course of the research, no deviations from, or changes to, the study or information/consent documents may be initiated without prior written approval from the REB, except for minor administrative aspects. Participants must receive a copy of the signed information/consent documentation. Investigators must promptly report to the Chair of the Faculty Sub-REB any adverse or unexpected experiences or events that are both serious and unexpected, and any new information which may adversely affect the safety of the subjects or the conduct of the study. In the event that any changes require a change in the information/consent documentation and/or recruitment advertisement, newly revised documents must be submitted to the Sub-REB for approval.

[redacted]

Dr. Alan Edmunds (Chair)

2011-2012 Faculty of Education Sub-Research Ethics Board

Dr. Alan Edmunds	**Faculty of Education (Chair)**
Dr. John Barnett	**Faculty of Education**
Dr. Farahnaz Faez	**Faculty of Education**
Dr. Wayne Martino	**Faculty of Education**
Dr. George Gadanidis	**Faculty of Education**
Dr. Elizabeth Nowicki	**Faculty of Education**
Dr. Immaculate Namukasa	**Faculty of Education**
Dr. Kari Veblen	**Faculty of Music**
Dr. Ruth Wright	**Faculty of Music**
Dr. Kevin Watson	**Faculty of Music**
Dr. Jason Brown	**Faculty of Education, Associate Dean, Research *(ex officio)***
Dr. Susan Rodger	**Faculty of Education, Western Non-Medical Research Ethics Board *(ex officio)***

The Faculty of Education Research Officer

[redacted]

Copy: Office of Research Ethics

Appendix B - Letter of Information

HIGH FIDELITY SIMULATION: PANACEA OR POTENTIAL PROBLEM?

LETTER OF INFORMATION

Introduction
My name is Mark Hunter and I am a graduate student in the Faculty of Education at The University of Western Ontario. I am currently conducting research into the use of high fidelity simulation mannequins in health science education and would like to invite you to participate in this study.

Purpose of the study
The aims of this study are to explore the nature of the experience that students have when working with high fidelity simulation mannequins.

If you agree to participate
If you agree to participate in this study you will be asked to have a typical lab interaction with the high fidelity simulation video-recorded. Following your lab you may be asked to participate in an interview of approximately 30 minutes in length during which we will discuss your experience with the high fidelity simulation mannequin. Interviews will be conducted on campus, audio recorded and then transcribed into written format. You will not be compensated for your participation in this research study.

Confidentiality
The information collected will be used for research purposes only, and neither your name nor information which could identify you will be used in any publication or presentation of the study results. All information collected for the study will be kept confidential. All information gathered in this study will be stored in a secure environment. After the study is completed all information will be destroyed.

Risks & Benefits
There are no known risks to participating in this study.

Voluntary Participation
Participation in this study is voluntary. You may refuse to participate, refuse to answer any questions or withdraw from the study at any time with no effect on your academic status or your participation/evaluation in this course. Please note that all members of your lab group must agree to participate in the study in order for video-recording to take place. Even if all other members of your group agree to participate, you should not feel obligated to do so if you do not wish to participate.

Questions
If you have any questions about the conduct of this study or your rights as a research participant you may contact the Manager, Office of Research Ethics, The University of Western Ontario at [redacted] If you have any questions about this study, please contact Mark Hunter, at [redacted] or my faculty advisor, Dr. Sandy Deluca, at [redacted] This letter is yours to keep for future reference.

Appendix C - Consent Form

HIGH FIDELITY SIMULATION: PANACEA OR POTENTIAL PROBLEM?

Mark Hunter
Faculty of Education
School of Graduate and Postdoctoral Studies
The University Of Western Ontario
London, Ontario

CONSENT FORM

I have read the Letter of Information, have had the nature of the study explained to me and I agree to participate. All questions have been answered to my satisfaction.

Name (please print): ___________________________

Signature:____________________________________ Date:__________________

Name of Person Obtaining Informed Consent:______________________________

Signature of Person Obtaining Informed Consent:__________________________

Date:________________________

Curriculum Vitae

Name:	Mark Hunter
Post-secondary Education and Degrees:	University of Western Ontario London, Ontario, Canada 1983-1988 BScN
Honours and Awards	The Association of Canadian Community Colleges National Teaching Excellence Award 2005 Fanshawe College President's Distinguished Teacher Award 2005
Related Work Experience	Registered Nurse St. Joseph's Health Care London London, Ontario, Canada 1988-2000 Professor / Academic Coordinator Fanshawe College London Ontario, Canada 1991-2012 Research Assistant University of Western Ontario London Ontario 2008-2009 Curriculum Consultant Fanshawe College London, Ontario, Canada 2012-2013 Acting Chair, School of Public Safety Fanshawe College London, Ontario, Canada 2013-present

Publications:

Kueneman, J. & Hunter, M. (2010). The Medical Radiation Technologist: A valuable resource. In T. Van Deven, K. Hibbert & R. Chhem (Ed.), *The practice of radiology education: Challenges and trends.* Berlin, Germany: Springer

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