SIMULATION TO TEACH PATIENT TRANSFERS:

THE ROLE OF SELF-EFFICACY

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SIMULATION TO TEACH PATIENT TRANSFERS: THE ROLE OF SELF-EFFICACY

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Transferring patients is a complex activity that can result in injury to the patient and healthcare professional. There is currently no widespread standard method to teach therapy students patient transfer skills. Simulation is one method to educate students to safely transfer patients, however, research examining the use of simulation to teach and evaluate patient transfer skills is limited. For this study we developed acute care scenarios with embedded critical events to teach transfer skills to occupational therapy students in the context of a medical theatre and with the use of a simulator, SimMan®. Scenarios mimicked common situations encountered when treating a medically complex patient. These situations included management of respiratory equipment, management of external lines, drains and tubes, and management of medical instability during the patient encounter. Performance assessment forms for each scenario provided objective criteria to assess student learning and performance. Using cognitive learning theory, the relationship between active participation and active observation was examined. Knowledge, skill, and safety self-efficacy data were collected. Over time, students with a combination of observation and participation experiences reported no difference in self-efficacy ratings when compared to students with participation experiences only. However, after the second exposure to SimMan®, skills self-efficacy ratings were greater for students who actively participated twice and observed once. Self-efficacy ratings after transfer experiences were not predictive of future performance of transfer tasks. Self-efficacy declined between the classroom and the medical theatre, and increased with repeated exposures to SimMan® scenarios. Ratings for knowledge and skills self-efficacy were closely related to each other over time and across classroom, simulation center and clinical environments. In contrast, safety self-efficacy ratings were more closely associated with environmental changes.

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PREFACE

The completion of this study would not have been possible without the professional support of my dissertation committee. I thank my committee chair, Margo B. Holm, PhD, OTR/L, for her ongoing expertise, guidance, and mentorship. Joan C. Rogers, PhD, OTR/L, provided resources and departmental support as well as sound research advice. John M. O'Donnell, CRNA, MSN, DrPH, freely shared his enthusiasm and expertise in research and simulation. Ketki D. Raina, PhD, OTR/L, brought the Innovations in Education grant to fruition and kept me with her every step of the way. Elaine Rubenstein, PhD assisted me with the statistical analysis and interpretation and provided additional professional support.

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1.0 INTRODUCTION

Although transferring patients is a complex activity that can result in injury to the patient and healthcare professional, there is currently no standardized method for teaching manual patient handling, including transfers (Resnick & Sanchez, 2009). In addition, often there is no consistent manner used to educate students about patient handling. When it does occur, patient handling education is often held in a classroom setting that does not represent accurately the complexity of the patient’s condition or the hectic environment of a healthcare setting (Resnick & Sanchez, 2009). Research has focused on the high injury rate associated with patient handling within the healthcare professions, calling into question the use of manual patient transfers and educational methods (Nelson, Fragala, & Menzel, 2003).

Simulation is one method that can be used to educate students to safely handle and transfer patients. Simulation is an interactive method designed to mirror actual clinical situations with guided experiences (Nishisaki, Keren, & Nadkarni, 2007). There are several advantages to using simulation as an instructional method, including standardization of instructions and procedures and integration and assessment of student problem solving skills (McGaghie, Issenberg, Petrusa, & Scalese, 2010). However, the expense of simulation and the lack of rigorous research to support simulation’s superiority over other teaching methods are consistent criticisms of this methodology (McGaghie et al., 2010).

There is a paucity of literature examining the use of simulation to teach and evaluate handling skills for patients in healthcare settings (O'Donnell et al., 2010, 2011; Wu & Shea, 2009). In the past decade, however, there have been significant changes in medical education (Mann, 2002). These changes include a greater emphasis on the learning environment and methods to facilitate the learner's memory and thinking (Issenberg, et al., 2005; Mann, 2002) In addition, there has been a focus on student self-evaluation, including the use of feedback to improve decision-making skills (Lasater, 2007), and the relationship between self-efficacy and performance outcomes (Bandura, 1997; Bandura & Locke, 2003; Colquitt, LePine, & Noe, 2000; Salas & Cannon-Bowers, 2001; Stajkovic & Luthans, 1998).

Although simulation is used for training medical professionals, there is little evidence of its effectiveness for teaching patient handling and transfer skills to healthcare professionals outside of nursing (Nehring & Lashley, 2009). In addition, there is conflicting evidence of the role self-efficacy plays in learning through simulation. Some researchers have found that greater self-efficacy is associated with better performance (Colthart, et al., 2008; Ellis, Ganzach, Castle, & Sekely, 2010). However, other researchers have found that greater self-efficacy beliefs do not consistently equate to better task performance (Barnsley et al., 2004; Davis et al., 2006; Leopold et al., 2005).

Medical education today includes a wide spectrum of teaching methods, and simulation is just one of these methods. The use of simulation to teach patient transfer skills and the role of self-efficacy in influencing the performance of these skills was deemed worthy of further investigation.

1.1 AIMS AND HYPOTHESIS

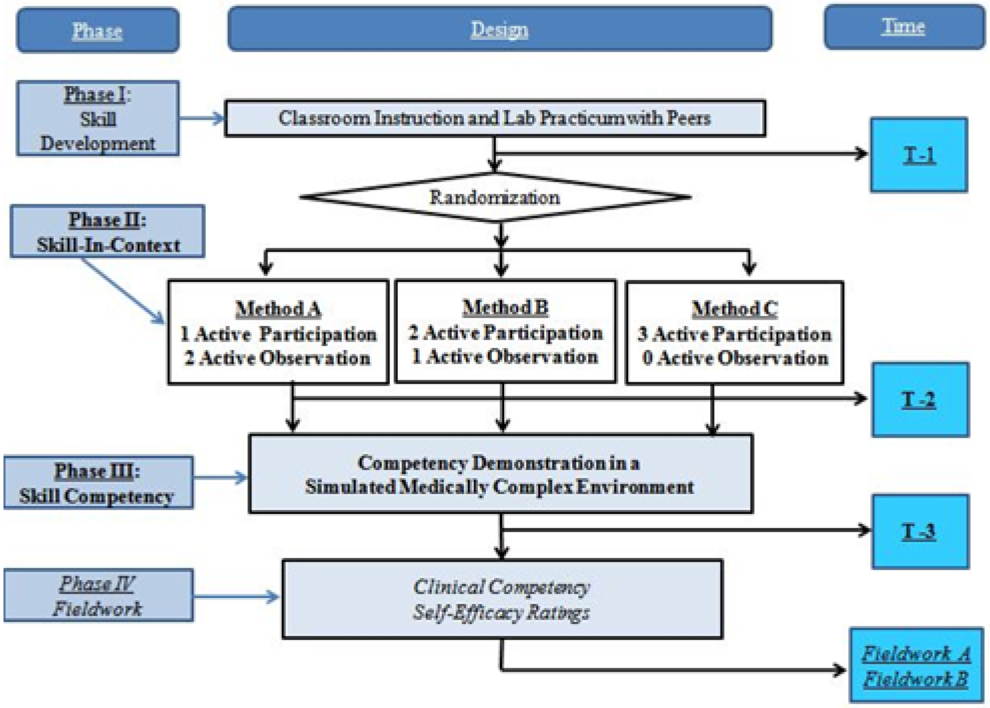
This study was part of a larger project to assess the learning effectiveness of simulation to teach occupational therapy students patient transfer skills. It had two purposes. The first purpose was to create acute care scenarios that nested a critical event into a patient transfer from the bed to the wheelchair for use in simulations. These scenarios had to be parallel in difficulty and possess a high level of ecological validity. This aim was met by the creation of seven scenarios that mimic common acute care situations and had equivalent levels of difficulty.

The second purpose was to examine self-efficacy as it related to teaching method and time. As Bandura (1986) described it, self-efficacy refers to beliefs regarding one's ability to perform a defined task in a specific situation. To closely and methodically examine the relationship between self-efficacy and learning, four aims were proposed. All aims related to knowledge, skills and safety self-efficacy as they pertained to study time points (T) and teaching methods. (See figure 1.1).

Aim 1: To compare the levels of knowledge self-efficacy, skills self-efficacy and safety self-efficacy by teaching method. Aim 1 had one hypothesis:

- H1: At T3 there would be no difference in knowledge self-efficacy, skills self-efficacy and safety self-efficacy for students assigned to teaching Methods A , B or C.

Rationale: Methods A and B combined active participation (performance of a transfer) and active observation (observation of peer performance of a transfer). This comparative information would assist with successful task completion, and successful task completion contributes to higher levels of self-efficacy (Bandura, 1986, 1997). The addition of active observation was an important component in this project. The exposure to active observation learning experiences is known to help the learner form motor programs that assist with imitation (Massen, 2009). In addition, the use of active observation in a simulated situation exposes students to the consequences of their actions (Rogers, 2007).



T = Time
Figure 1.1 Study Design

Methods A and B were designed with only one experiential difference in exposure type (active observation versus active participation). We believed this minimal difference in exposure would not be sufficient to differentiate participant formation of self-efficacy beliefs. Teaching Method C did not allow for any active observation experience. This limited students to active participation learning experiences only. However, the repeated opportunities to practice transfer tasks actively in a hands-on role could allow for formation of self-efficacy based on performance. Task performance is an extremely strong generator of self-efficacy belief (Bandura, 1997), and may outweigh the observation experiences of the participant.

Aim 2: To compare the levels of knowledge self-efficacy, skills self-efficacy and safety self-efficacy by time. Aim 2 had two hypotheses:

- H2A: There would be a significant decrease in levels of knowledge self-efficacy, skills self-efficacy and safety self-efficacy from T1 to T2.

Rationale: Recent classroom and laboratory experiences that included successful performance of transfers involving peers and completion of a paper and pencil examination would contribute to positive perceptions of self-efficacy at T1. At T2 the participants completed transfers in a simulated hospital environment using simulators (mannequins). The manual handling tasks at T2 required a more sophisticated set of skills and exposed participants to unexpected critical clinical events (e. g., bradycardia, postural hypotension) and an acute care environment. In these situations they had less control of subsequent events, which could cause a decrease in self-efficacy beliefs (Bandura, 1993).

- H2B: There would be a significant increase in levels of knowledge self-efficacy, skills self-efficacy and safety self-efficacy from T2 to T3.

Rationale: Simulation experiences were more challenging due to the total dependency of the simulator mannequin, the realism of the acute care environment, and the inclusion of a critical event embedded within the scenario at T2. These challenges required an integration of skills and a higher level of knowledge application than was necessary previously to succeed. However, similar skills and the same environments were also used at T3. This consistency allowed participants to predict events and develop methods of problem solving and management. This ability to process information and regulate a response could result in an increase in self-efficacy beliefs (Bandura, 1993).

Aim 3: To predict skill competency at Phase III from levels of knowledge self-efficacy, skills self-efficacy and safety self-efficacy at T1 and T2. Aim 3 had two hypotheses:

- H3A: Student knowledge self-efficacy, skills self-efficacy and safety self-efficacy ratings at T1 would predict skill competency scores at Phase III.

Rationale: Self-efficacy has been shown to influence performance (Bandura, 1997), and higher self-efficacy ratings can influence performance in a positive manner. Higher self-efficacy ratings based upon initial experiences with transfers at T1 should translate to stronger skill competency scores at Phase III, which reflect performance during the scenarios.

- H3B: Student knowledge self-efficacy, skills self-efficacy and safety self-efficacy ratings at T2 would predict skill competency scores at Phase III.

Rationale: Because self-efficacy beliefs influence performance, higher self-efficacy ratings at T2 should predict greater capability and subsequent skill utilization (Bandura, 1993). The self-efficacy beliefs could positively influence the successful completion of the scenario, which is measured by the skill competency score.

Aim 4: To examine the association between levels of knowledge self-efficacy, skills self-efficacy and safety self-efficacy at T2 and T3 with levels of knowledge self-efficacy, skills self-efficacy and safety self-efficacy at Fieldwork A and B. Aim 4 had no hypothesis, and was exploratory in nature.

1.2 ORGANIZATION OF THIS DISSERTATION

Chapter 2 is comprised of a literature review examining research and current theories as they relate to guidelines for safe patient handling, the use of simulation in clinical education, learning theories associated with simulation, self-efficacy, the learning environment, and participation and observation. This background information serves as the foundation for this study.

Chapter 3 is a stand-alone qualitative article which describes the scenario development for the major study. The intent of each scenario was to mimic common clinical situations in acute care. The scenarios were designed to embed a unique critical patient event within a consistent simulation patient handling task: a bed to wheelchair transfer. The criteria for scenario development, the unique critical patient events and their clinical relevance, and student responses to the scenarios are discussed.

Chapter 4 is a stand-alone quantitative article which examines self-efficacy and performance on the simulation patient handling task and real-time patient handling tasks during clinical fieldwork. To determine its effect upon performance, self-efficacy is assessed across teaching methods and over time. The levels of knowledge self-efficacy, skills self-efficacy, and safety self-efficacy and performance over time are discussed.

Chapter 5 is a summary of the results and conclusions of this study, limitations of this study, and suggestions for future research.

2.0 BACKGROUND

A major challenge for clinical education is determining the most effective and efficient manner of teaching complex, hands-on skills (Hutching, Williamson, & Humphreys, 2005). Learning to transfer patients is a hands-on skill required of occupational therapy students (Wu & Shea, 2009). Traditional didactic methods for teaching students how to transfer and handle patients include the use of lecture followed by physical practice with peers. However, feedback from the American Occupational Therapy Association Student Evaluation of the Fieldwork Education Task Force indicates that this education does not adequately prepare students for transferring medically fragile and clinically complex patients (AOTA SEFWE Task Force, 2006).

As changes in healthcare have evolved, the length of a hospital stay has progressively decreased while the clinical complexity of patients has increased, resulting in medically fragile patients who move through the healthcare continuum rapidly (Kneebone, Nestal, Vincent, & Darzi, 2007; Pardes, 2000). This increase in medical fragility further emphasizes the need for effective safe patient handling education to ensure the skill and competency of occupational therapy graduates.

One solution to the dilemma of teaching skills in a real life context while ensuring patient safety is the use of simulators. Simulators are mannequins or humans acting as patients embedded within clinical education or testing scenarios (Resnick & Sanchez, 2009). The use of simulators allows for safe, repetitive practice within a clinically accurate environment. This has been an effective teaching mechanism in medical education (Issenberg et al., 2005). However, the use of simulator technology is expensive (Kneebone et al., 2007) and not widely available to occupational therapy educators (Wu & Shea, 2009).

This project exposed students to differing levels of simulator education using two instructional methods. In one method, students actively participated by completing hands-on transfers. In the other method, students actively participated and also actively observed by watching and rating peers who completed a hands-on transfer. All transfers occurred within an acute medical environment and each transfer was set within a scenario that presented a critical event. Simulated scenarios addressed events consistent with clinically complex and medically fragile patients. Project goals included the development of clinical scenarios that depicted critical situations and required the use of clinical judgment. Another goal was to promote problem solving to prevent an adverse event, and to assess the relationship between self-efficacy and performance to determine the clinical utility of medical simulation used as a learning tool for occupational therapy students.

As a basis for understanding these topics, this literature review addressed the following areas: (a) current industry recommendations for patient handling, (b) the history and background of simulation technology, (c) learning theories that promote the use of simulation as a tool for education, (d) self-efficacy, simulation and learning, (e) the importance of environment, (f) learning through participation and observation.

2.1 FEDERAL GUIDELINES FOR SAFE PATIENT HANDLING

While in most industries the rate of musculoskeletal disorders (MSDs) has declined, this has not been true for the healthcare industry, where MSDs involving the back and shoulders continue to rise. These MSDs are considered one of the most costly healthcare problems in the United States (Bureau of Labor Statistics, US Department of Labor, 2008). The cause of these injuries is thought to be the repeated musculoskeletal stress from patient handling tasks as well as the awkward static postures adopted when performing daily patient care (Nelson, Motaki, & Menzel, 2009). Additional factors contributing to increased healthcare professional injuries include an increase in obesity of the average adult patient, an increase in the mean age of the nursing professional, and a routine shortage of healthcare professionals. This shortage is thought to result in increased working hours and extra job assignments (Waters, Nelson, Hughes, & Menzel, 2009). In response to escalating MSDs in the healthcare industry, federal agencies such as the National Institute for Occupational Safety and Health (NIOSH), the Occupational Safety and Health Organization (OSHA), and the Department of Health and Human Services (DHHS) have formed alliances to create guidelines that promote safe patient handling. These guidelines have been developed for the healthcare workplace, such as inpatient facilities and skilled nursing facilities, and for academic institutions that educate healthcare workers, such as nursing schools and programs for nursing assistants and aides.

Previously NIOSH addressed manual lifting in industries other than healthcare using a guide for manual lifting based on a lifting equation (Waters, Putz-Anderson, & Garg, 1994). This lifting equation was designed to mathematically calculate a weight limit for a specific task within the parameters that would allow a worker to repeatedly complete this task for up to 8 hours without increasing the risk for low back pain. NIOSH at that time stated that this lifting equation could not be applied to the lifting of patients because of the unpredictability of conditions surrounding a patient lift. These conditions involve, for example, patient cooperation or involuntary resistance due to abnormal muscle tone, as well as the segmental aspect of the required movements, all of which prevent a smooth lift of a stable object. However, this lifting equation has since been applied to manual patient lifting (Waters, 2007). The lifting equation takes into consideration such factors as the frequency of the movement, the distance between the body and the object (patient), the weight of the object (patient), and the ability of the worker to firmly grasp the object (patient). The conclusion of the lifting equation substantiated a 35-pound weight limit for safe patient lifting. The implications of this recommendation are far reaching for healthcare as many tasks exceed this limit. However, proponents of adopting this recommendation cite the rising rate of MSDs in the healthcare industry, and the availability of mechanical lifting devices (Waters, 2007).

Recently NIOSH developed a curriculum guide to assist schools of nursing to educate students about safe patient handling, which includes safe manual patient handling techniques (Waters et al., 2009). Citing evidence that manual patient handling even with proper body mechanics is unsafe, NIOSH collaborated with the Veteran's Health Administration and the American Nurses Association to publish guidelines that promote updated education with a focus on proper use of technology and equipment in addition to traditional biomechanical training. The foundation of this education is that "…there really is no safe method to manually lift another adult human being" (Waters et al., 2009, p. 6). The curricular material further states, "Body mechanics alone… is not sufficient to protect the nurse from the heavy weight, awkward postures, and repetition involved in manual handling" (Waters et al., 2009, p. 7). The use of body mechanics alone to manage patient movement has been criticized because the research that substantiates this does not approximate a true healthcare environment (Nelson et al., 2009). Although most healthcare professionals responsible for patient lifting are women, manual lifting techniques are not based on studies of women. While a significant amount of MSDs affect the neck, shoulders and upper back, most manual techniques are designed to primarily protect the lower back, and are based on holding a heavy object firmly and close to the body, something that is difficult to do with another human. Finally, manual lifting techniques were developed using loads that weighed less than the typical patient (Nelson et al., 2009; Waters et al., 2009).

The underlying premise of the curriculum guide is that safe patient handling will lead to a decrease in the number of healthcare professionals with MSDs. The principles of safe patient handling include the use of ergonomics, defined as, "…fitting the job to the worker…" (Waters et al., 2009, p.11). Specifically, this entails designing the equipment, environment, and tasks to the worker, rather than expecting the worker to adapt to job demands and workplace design. The curriculum guidelines consist of a two-hour slide presentation, a series of algorithms for safe patient handling, didactic materials such as required reading, and laboratory activities.

The slide presentation focuses on ergonomics, risk factors for musculoskeletal injuries, recognition of high-risk patient care activities and environments, and identification of problem solving strategies. The algorithms are decision-making trees that address patient handling activities. There are six basic patient algorithms, seven bariatric patient algorithms, and four orthopedic patient algorithms. The algorithms address transfers supine to sit, and lateral transfers in/out of bed or in/out of a chair. Additional guidelines for repositioning in bed and in a chair and floor transfers are also provided. These guidelines are based on an assessment of patient weight and capabilities, including weight bearing, cooperation, and upper extremity strength. The assessment criteria, care plans, and clinical guidelines are provided, including flowchart algorithms to determine when it would be safe to manually move a patient. This information, while part of the Waters et al. (2009) curricular materials, was taken from original work done at the Department of Veteran's Affairs (2009).

Although NIOSH focuses on safe lifting and movement of patients through the creation of specific curricular guidelines and patient algorithms, the reader is encouraged to apply the principles to any situation in which the physical handling of patients may result in work-related MSDs (Waters et al., 2009). In contrast, OSHA's recommendations are written specifically for nursing homes to decrease MSDs using ergonomics (OSHA, 2009). These guidelines have two focus areas. The first focus area includes lifting of residents/patients. The second focus area is the design and implementation of a facility wide ergonomics program to identify specific problems, implement solutions, provide staff education and continually evaluate the effectiveness of the program (OSHA, 2009). OSHA recommends "…manual lifting of residents be minimized in all cases and eliminated when feasible" (2009, p. 9). OSHA adopted the same algorithms presented in the NIOSH document for safe patient handling education for nursing students. NIOSH presents these as sample guidelines for nursing homes and skilled nursing facilities to adopt. The OSHA guidelines (2009) also detail equipment available to assist healthcare staff with patient handling, including bathroom equipment, mechanical lifts, and devices to assist with repositioning such as electric beds and trapeze bars.

These guidelines offer some specific decision trees and objective criteria for making decisions. Some areas within the manual are specific, such as the best way to move a resident, or complete other jobs, such as laundry and housekeeping tasks while other areas are more general. There are general sections addressing the facility ergonomics program and staff education that do not provide specific information but rather overall program component suggestions. Recommendations for staff education emphasize an understanding of the facilities’ policies and procedures to avoid injury, the early indicators of MSDs, and the procedures to report work-related injuries, but do not provide examples of these. The guidelines also state that all staff members should complete ergonomics education. This education should be done consistently to ensure accurate evaluation of the effectiveness of implemented solutions (OSHA, 2009).

Manual lifting is a high-risk activity for both nurses and patients and the use of ergonomics programs alone has not helped prevent job-related injuries (Nelson et al., 2003). Recommendations to decrease injury to staff and increase patient safety include ergonomic assessment of the patient care environment, the use of mechanical devices, and standardized protocols for assessing patient handling and moving (Nelson et al., 2003).

Because of the high risk of manual lifting and the risk posed to both the patient and professional, simulation has been used to teach these skills to medical professionals (O’Donnell et al., 2010, 2011). The use of simulation has not been limited to transfer education, however. There are multiple classifications and uses of simulation. Many of these are explored in the next section.

2.2 THE USE OF HUMAN AND ARTIFICIAL SIMULATORS FOR CLINICAL EDUCATION

Simulation has been defined as an interactive method to mirror actual clinical situations with guided experiences (Nishisaki, Keren, & Nadkarni, 2007). Simulation has been used in a variety of high-hazard fields to improve safety including the military, aviation, and manufacturing

(Nishisaki et al., 2007). Simulation is uniquely suited for teamwork training, evaluating competency, investigating human performance, and establishing an environment for discussion of errors without real consequences (Fox-Robichaud & Nimmo, 2007; Kunkler, 2006). Simulation is "…safe, reproducible, repeatable, planned, and convenient" (Fox-Robichaud & Nimmo, 2007, p.739). Simulation used in the medical and healthcare professions has increased over the last several years. This type of training has been found to be effective in the increasingly limited time available to medical educators (Cooper & Taqueti, 2008; Kunkler, 2006).

Simulation involves either a person or the use of a low or high fidelity mannequin. Simulation using a layperson trained to assume a diagnosis or disability is referred to as a standardized patients (SP). The first documented use of SPs occurred in 1963 when, under the direction of Dr. Howard S. Barrows at the University of Southern California an artist model portrayed an individual with paresis resulting from multiple sclerosis (Wallace, 1997). Simulation continues to be a widely accepted method for teaching and testing medical professionals (Panzarella & Manyon, 2007). The use of a SP can take the form of an isolated patient encounter between a healthcare professional and the actor, with the interaction student-directed thus resulting in an open-ended conclusion (e. g., a single standardized patient used as part of clinical education class to teach diagnostic skills). This use of SPs is termed a simulated clinical encounter (SCE).

In contrast, the use of SPs during an academic examination results in a pre-determined conclusion. In this situation, each station requires the student to demonstrate a specific skill as when confronted with different clinical problems (e.g., multiple SPs in structured stations used as part of clinical examinations leading to a predetermined conclusion). This use of SPs is an observed structured clinical examination (OSCE). The majority of medical education programs use OSCEs to test clinical competency (Panzarella & Manyon, 2007; Vessey & Huss, 2002). These terms (OSCE, SP and SCE) are prevalent throughout the healthcare literature (Vessey & Huss, 2002).

The use of SPs has distinct advantages for teaching and assessment of clinical competence. SPs are able to express complex emotions and convey ethical concerns that a mechanical simulation cannot (Barrows, 1993; Panzarella & Manyon, 2007), and the encounter can be manipulated to attain differing levels of complexity instantaneously (Barrows, 1993; Vessey & Huss, 2002). In addition, the SP can provide immediate feedback regarding the student's bedside manner. Because these individuals are acting, they are able to tolerate more complete and extensive interventions over a longer time due to the slower speed of a student. This slower pace is not always tolerated by actual patients with limited endurance, thus the use of simulation allows learning without patient harm (Barrows, 1993; Vessey & Huss, 2002).

However, there are drawbacks to using patient actors. SPs are expensive and resource intensive (Stevens et al., 2006). The ability to simulate clinical conditions, and assess clinical skills is limited. There are approximately 60 confirmed conditions that have been simulated, but some require recruitment of lay actors with a previously existing, underlying disorder, such as a heart murmur (Barrows, 1993). In addition, especially fragile populations are difficult to simulate, such as the frail elderly or children (Vessey & Huss, 2002). Also problematic is the unexpected interaction between the actor and the student, which can uncover flaws in the SP's training if it is not thorough enough, or make academic grading difficult to quantify because of the subjectivity of some interactions (Barrows, 1993; Vessey & Huss, 2002).

In contrast to a live actor coached to be a patient, simulations can be completed using inanimate mannequins, otherwise known as human patient simulators (HPS). At the least complex level, HPS are task trainers. These are simple devices that mimic body parts and allow for practice of a multitude of simple to complex invasive tasks. Simulation of many types of tasks can be done with a task trainer. These range from basic tasks such as suturing, or inserting an intravenous line or urinary catheter, to more complicated tasks, such as completing a lumbar puncture or anesthetic procedure (McGaghie et al., 2010). Full body mannequins are more complex HPS. They can actively simulate bowel sounds, as well as respiratory and cardiac functions. These functions are realistic and computer driven, allowing for programming of episodic critical events designed to enhance student learning. At the most complex level these HPS interface with computerized systems allowing the student to experience a virtual reality situation, such as a simulated surgery, wherein the HPS connects to a computer monitor with a programmed response. The medical student performs the surgery with the assistance of current surgical technology (micro-cameras, arthroscopic techniques), and the computer responds to the interventions (McGaghie, et al., 2010). Therefore, if the simulated surgery is botched, the HPS responds with the appropriate medical or physical instability.

There are many advantages of HPS, including the inability to induce any true harm to a human, thereby providing an environmentally appropriate situation without risk. In addition, the use of these inanimate simulators allows educators to create structured learning situations and outcome based assessments (Isenberg et al., 2005; Lammers et al., 2008). Simulators used this way also allow educators to provide a consistent learning experience for each student (Issenberg et al., 2005; Rothgeb, 2008). While is it accepted that the use of HPS as a teaching method eliminates the risk of a student harming a live patient, their specific application to learning and their superiority as a learning methodology has been questioned (Issenberg et al, 2005; Wenk et al., 2009). Critics of simulator training cite concerns that students practicing repeatedly with simulated models will not be able to transfer their skills to real patients with a variety of differences (Alinier, 2007). Critics also cite the lack of evidence that repeated performance of specific medical procedures completed with simulations increases competence (Châtenay et al., 1996; Jolly et al., 1996; McManus, Richards, Winder, & Sproston, 1998; Morgan & Cleave-Hogg, 2002). The high cost of simulation technology is also a drawback for its use (Stevens et al., 2006).

On behalf of the Best Evidence Medical Education (BEME) Collaboration, several literature reviews of simulation use were conducted (Issenberg et al., 2005; McGaghie et al., 2010). The reviews resulted in the discovery of the twelve best practices and features associated with simulation used as part of the learning and education of healthcare professionals. These are the following (McGaghie et al., 2010):

- The consistent use of feedback to the student during the learning experience, whether verbal and immediately after the simulation, or later as a video review
- Deliberate practice that is learner-centered
- The integration of the simulation into the overall curriculum (the simulation must complement the curriculum)
- Outcome measurement is based upon reliable data and valid actions
- Simulation fidelity (realism of the simulator; the goals of the simulation and the tools used match)
- Skill acquisition and maintenance (skills are procedural, professional, cognitive and group)
- Mastery learning (understanding that the time needed for mastery will vary with the individual)

- Transfer to practice (results transfer from the learning environment to real patient care settings)
- Team training (an important educational goal achievable with simulation; ineffective teamwork leads to adverse clinical outcomes)
- High-stakes testing (research advances drive new test applications)
- Instructor training (teaching using simulation is not intuitive and clinical experience cannot substitute for instructor effectiveness)
- Educational and professional environment is critical, dynamic and adaptive

Of these best practices consistent use of feedback, deliberate practice, and integration into the curriculum were the most effective features of simulation (Issenberg, et al., 2005). Feedback provided during the learning experience has been reported as the most critical component, and is frequently cited as the one most important learning factors associated with simulation (Issenberg, et al., 2005).

Recent studies comparing the use of education using simulation to other traditional didactic methods, such as problem-based or case-based learning, have not shown a significant performance improvement, either in procedural or cognitive examinations (Schwartz, Fernandez, Kouyoumjian, Jones, & Compton, 2007; Wenk et al, 2009). In both of the studies a randomized controlled design was used to compare medical students' clinical skills and theoretical knowledge of a specific medical issue (cardiac arrest or rapid sequence induction anesthesia). It has been argued that simulation should not be used in isolation as a teaching method, but instead alongside a variety of teaching methods that are aimed at mastery of a specific skill (Alinier, 2007).

2.3 LEARNING THEORIES APPLIED TO SIMULATION EDUCATION

One challenge for healthcare education is the application of didactic knowledge to clinical situations. Resources that allow students to practice critical thinking, decision-making, and problem solving are especially valuable (Nehring, Lashley, & Elllis, 2002; Rothgeb, 2008). Simulations can create situations to assist the student's ability to transfer knowledge to practice. Many learning theories have been associated with simulation use in healthcare education. The adult-learning, novice-to-expert, constructivism, experiential, and cognitive learning theories will be explored here.

2.3.1 The adult-learning theory

The adult-learning theory postulates that simulation endorses the life-long learning of adult learners as adults are generally self-motivated to achieve objective and relevant goals (Rodgers, 2007; Rothgeb, 2008). The adult-learning theory is based on several assumptions. One assumption is that adult learners need to understand why acquiring knowledge is important before it will become meaningful. Another assumption is that adult learners are self-directed and have an innate readiness to learn.

Simulation education provides opportunities for successful goal attainment by task completion through self-directed methods, and offers clinically relevant and appropriate environments and situations for learning. The reasoning behind the task performance is evident to the learner and the realism associated with the simulation provides the foundation that an adult learner needs to understand why performance is important.

2.3.2 The novice-to-expert theory

As learners become more proficient, there is a shifting set of rules that guide learning and performance (Rodgers, 2007). This belief is the foundation of the novice-to-expert theory. Novices follow set and defined rules despite the environment that surrounds them. Experts base responses more on the entire situation, including the environment and associated factors, and less on associated rules (Moran & Cleave-Hogg, 2002). Some theories have categorized learners as they move through different stages. These stages begin with the novice or beginner stage, progress to the proficiency stage, and move to the expert stage. Some have also included a final mastery stage (Rodgers, 2007).

The use of progressively complex and difficult scenarios and procedures taught using simulation techniques aligns with this theory. The use of deliberate practice has been identified as an important tool to move through the steps to mastery (Rodgers, 2007). Deliberate practice is defined as practice of a well-defined task over a long time period, undertaken specifically to improve performance in that area (Issenberg et al., 2005; Rodgers, 2007). A mechanism underlying deliberate practice is the provision of feedback to the learner (Issenberg et al., 2005; Rodgers, 2007).

As an educational method, simulation strongly endorses the novice-to-expert learning theory. Simulation can be designed to provide deliberate practice. Opportunities for repetition and practice, and the debriefing and videotaping that can accompany simulations allow for both immediate and delayed feedback. Many levels of students, both undergraduate and graduate, use simulation successfully (Lammers et al., 2008; O’Flynn & Shorten, 2009). Simulation promotes the skill development of beginners and advanced practitioners alike. Therefore, medical students learning new techniques use simulation and practicing medical professionals use simulation for continuing education (Rodgers, 2007; Ruthgrub, 2008).

2.3.3 The theory of constructivism

The theory of constructivism posits that the learner is consistently in an active role because knowledge is based on adding new experiences to the unique experiences and knowledge each learner has already acquired (Maudsley & Strivens, 2000; Rodgers, 2007). When knowledge does not fit a new situation, new learning can occur. Learning is environmentally based and socially relevant (Rodgers, 2007). This is particularly applicable to simulation because of simulation's learning environment, which imitates true clinical conditions.

One construct of constructivism is situated learning (Martin, 2009). Constructivism proposes that knowledge is specifically tied to the environment and the situation in which the learner acquires it, and that it is difficult for a learner to apply this knowledge outside of this specific situation (Elfrink, et al., 2010; Stein, 1998). As simulation provides realistic environments, translation of this knowledge should be less burdensome for the student, resulting in more ease of applicability. This complex learning environment lends itself well to another constructivist strategy; the use of guided, discovery learning. Discovery learning is not directive, and has been referred to as scaffolding (Rodgers, 2007). This is closely related to Vygotsky's zone of proximal development as interpreted by Kneebone, Scott, Darzi, and Horrocks (2004), who cite the similarities between the zone of proximal development and simulation. Both use similar individual and/or group teaching methods, to close the gap between what the learner knows and what performance is needed. Another common factor is the presence of an instructor or facilitator who assists with debriefing.

Situated learning emphasizes an environment conducive to learning, and inclusive of instructor feedback (Martin, 2009). Simulation has a positive learning environment, as no patient is harmed. Simulation also has the innate ability to provide guided feedback and for a learning experience that is automatically adjusted based upon the demonstrated need of the student.

2.3.4 Experiential learning

Experiential learning has also been applied to simulation. The theory of experiential learning emphasizes the importance of practice with feedback. When applied to simulation, the simulation experience is the practice and the debriefing experience is the feedback necessary for learning to occur (Rodgers, 2007). Kolb's model of experiential learning, which is often mentioned in simulation literature (Rodgers, 2007), contends that while expertise is developed with sustained practice over time learning is more than just repeated task performance (Hammond, 2004). The learner must reflect on the experience and integrate this knowledge for it to be meaningful. Students must be actively engaged in tasks performed in realistic environments for meaningful learning to occur (Hammond, 2004). As Rodgers (2007, p. 79) states, "It is this practice of connecting cause and effect that makes simulation with a subsequent debriefing an effective learning method."

2.3.5 The cognitive learning theory

The cognitive learning theory proposed by Bandura (1984) has direct relevance and applicability to the use of simulation as an educational tool. Cognitive learning theory (Bandura, 1986, 1993) bases psychosocial functioning on three main factors: (1) environment, (2) behavior, and (3) cognition. All these factors have an interactive and bidirectional relationship with each other, and are addressed in simulated learning situations.

According to cognitive learning theory, environment is an important influence on learning. The amount of perceived environmental control and the amount of environmental modifiability are keys to successful learning. Learning environments that promote comparison of progress and highlight accomplishments provide the best learning support (Bandura, 1993). The environment in simulated situations is both realistic and controlled, and can be manipulated to match the learners' needs.

The behavioral factor has two determinants according to Bandura (1986). These determinants are outcome expectations, and efficacy expectations. Outcome expectations are beliefs about the likelihood of achieving a successful outcome. Efficacy expectations are personal beliefs about being capable of executing certain actions. Efficacy expectations are thought to predict learning and achievement more strongly than outcome expectations (Bandura, 2007).

The cognitive factor is determined by self-efficacy, personal goal setting, and the quality of analytic thinking (Schwartzer, 1992). Self-efficacy is a judgment of one's level of competence in executing certain behaviors or achieving future outcomes. A strong sense of self-efficacy allows one to remain task oriented despite time constraints, situational demands, and judgment failures. Self-efficacy also influences motivation. Beliefs of self-efficacy influence which challenges one undertakes, how much effort one expends to be successful with a task, and how long one perseveres in the face of difficulties (Bandura, 1986).

Simulation offers multiple and varied opportunities for learning that address both behavior and cognition. First, simulation captures enactive learning, the active mastery of a task or clinical behavior. Simulation allows for the repetition needed for mastery of these behaviors that is only available in an artificial environment. Enactive learning recognizes that learning experiences result in an understanding of the consequences of the student's actions and behaviors. Because students can repeat tasks and experience learning with immediate feedback, the consequences of their actions are obvious. Each action links to an outcome that is evident in a realistic environment. The link between a student's actions and the consequences of those actions is experienced first-hand during simulation tasks. Other learning modalities do not offer this experience of consequences. These experiences are what define simulation as a powerful educational tool (Rodgers, 2007).

Second, simulation offers opportunities for vicarious learning. Videotaping and watching others perform tasks allows students to view tasks in exquisitely detailed and realistic environments, and the debriefing that often accompanies simulation-based tasks allows for verbal feedback that is specific and timely (Rodgers, 2007). Therefore, even if the student is not actively performing the task, the opportunity to learn still exists.

2.4 THE COGNITIVE LEARNING THEORY USED TO SUPPORT SIMULATION EDUCATION

Cognitive learning theory emphasizes the emotional and psychosocial aspect of learning as it relates to the learner's feelings of confidence (Bandura, 1997; Harder, 2010). This affects the learner's ability to cope with stressful situations (Bandura, 1997). Because healthcare practitioners must learn to perform under conditions that include multiple obstacles and must remain attentive to the task at hand and the needs of the patient, the emotional components of learning cannot be ignored (Harder, 2010). The ability to be emotional and yet remain engaged in a patient care task is critical to "…efficient and indelible learning in medicine" (Gordon et al., 2010, p. 371). Therefore, the relationship between feelings of confidence and clinical skills is important (Harder, 2010). In nursing literature this relationship has been further explored. There is evidence that feelings of fear and anxiety lead to decreased learning (Rhodes & Curran, 2005). Student's lacking self-confidence focus on feelings of anxiety and concern related to making an error (White, 2003). This fear of making a mistake can interfere with development of clinical judgment (White, 2003).

Therefore, while many theories are applicable to learning through simulation training, the cognitive learning theory especially lends itself to further investigation. Simulation and cognitive learning theory have also been applied to a variety of fields. Cognitive learning theory includes the specialized advantages of simulation, which focus on the realistic environment and the ability to provide multimodal types of feedback. And the cognitive learning theory also includes an emphasis on learner behaviors and how the psychosocial aspect of learning can affect performance. A major psychosocial aspect of learning is the construct of self-efficacy.

Cognitive learning theory is unique because it suggests that the domain of self-efficacy is directly and predictably related to learning and performance (Bandura, 1986). Self-efficacy is a guiding tenet of learning and thought to be predictive of the learner's response. Self-efficacy beliefs are complex, and based on multiple factors. These factors include information the learner obtains through enactive, vicarious, physiological, and behavioral means (Bandura, 1986). Simulation addresses all these learning pathways. Therefore, self-efficacy is a cornerstone of learning. Simulation can strongly influence self-efficacy. A discussion of self-efficacy is contained in the next section.

2.5 SELF-EFFICACY AND SELF-EFFICACY MEASUREMENT

Self-efficacy refers to beliefs regarding one’s ability to perform a defined task in a specific situation (Bandura, 1986). It is not equivalent to self-confidence, which is broadly applicable and a generalized personality characteristic. Self-efficacy is situation specific because it is based on experience and leads to, “…venturesome behavior that is within reach of one’s capabilities” (Schwartzer, 1992, p. ix). It is not equivalent to risk-taking behavior. Self-efficacy refers to the perception of personal control that one has over the outcome of a situation and is reflective of a sense of environmental influence (Schwartzer, 1992). Self-efficacy is measured as an individual’s belief. Specifically, self-efficacy is the belief people have “…of their capabilities to organize and execute courses of action required to attain designated types of performances” (Bandura, 1986, p. 391). It is distinct and separate from the knowledge and skills one has to perform a task.

Four major sources of information form the basis of self-efficacy beliefs. The first is an enactive mastery experience whereby the learner successfully masters the task or behavior. The second source for creation of self-efficacy is a vicarious experience. While not considered as strong as an enactive experience, a vicarious experience is often more frequently encountered than an enactive experience, especially within the healthcare profession, where learning experiences are often in observational groups (Pike & O’Donnell, 2010). The third source of self-efficacy beliefs is verbal persuasions of others. These verbal interactions communicate faith and confidence in another’s skills and abilities. The fourth and final source of self-efficacy beliefs is the physiological and emotional states experienced by an individual. For example, anxiety may be interpreted as a likelihood of not succeeding (Pike & O’Donnell, 2010).

Because self-efficacy is a subjective judgment of the future, it is not necessarily an accurate assessment of competence (Bandura, 1986, 1997). Learners must analyze and reflect on the task complexity and match this complexity to their perception of their capabilities. This self-appraisal contributes to a perceived operative capability (Bandura, 2007). Bandura (2007) discusses this as a belief of what one can do, rather than the skills that one has. However, this can lead to a mismatch between the conviction of efficacy beliefs and one’s actual ability. An individual can over- or under-estimate capabilities. Overestimating capabilities may boost performance and increase motivation to persist even against obstacles or setbacks, while underestimating may limit productivity and effort (Bandura, 2007).

Self-efficacy can become a predictor of performance and practice behaviors (Docherty, Hoy, Topp, & Trinder, 2005; Lorenz, Gregory, & Davis, 2000). Self-efficacy is also viewed as, “…an outcome of clinical training” (Lorenz et al., 2000, p. 182). Feelings of self-efficacy can influence the actions taken, approaches used, and amount of time and effort invested toward task completion (Docherty et al., 2005). Because the most important influence on self-efficacy is successful performance of the specific behavior under question (Bandura, 1986), self-efficacy has been linked to goal attainment and should translate to desirable patterns of clinical practice (Lorenz et al., 2000). However, performance is not the only influence on self-efficacy. Self-efficacy can be changed independently of performance. Factors such as knowledge and sub-skills also contribute strongly to self-efficacy (Schwartzer, 1992).

Conversely, a lack of self-efficacy has been regarded as a barrier to desirable professional practice behaviors (Lorenz et al., 2000). Studies in multiple disciplines, including work-related performance, academic performance, and athletic performance, demonstrate that beliefs of personal efficacy contribute to positive and negative human performance (Ellis et al., 2010).

One of the most important aspects of self-efficacy is its domain specificity (Artino & McCoach, 2008; Bandura, 1986; Pajares, 1996). Individuals judge their capabilities based upon particular skills and circumstances, thus self-efficacy is dependent on the learning environment. To achieve validity, measures of self-efficacy must both be tailored to each domain measured, and have gradations of task demands within each of these domains (Artino & McCoach, 2008; Bandura, 1986). A Likert scale is commonly used to measure self-efficacy. This scale is completed by the individual as a self-assessment measure. Items used to measure self-efficacy constructs vary based on the task or behavior being assessed, but have been found to have commonalities in question format and rating scales. Most self-efficacy survey questions assess self-efficacy by asking participants to rate how confident or how sure they are about performing a particular task or understanding a construct. Ratings scales ranged from a 4-point ordinal scale to a 100-point ordinal scale (Artino & McCoach, 2008; Bandura, 1993; Bandura & Cervone, 1983; Pajares, 1996; Shell, Colvin, & Bruning, 1995).

2.6 SELF-EFFICACY, SIMULATION, AND LEARNING

There is a demonstrated need to educate students to handle patients safely. Grisbrooke and Pearce (1999) stated that all universities have a legal, professional and academic responsibility to prepare medical and healthcare students for manual handling, as this is integral to practice. Current methods to teach occupational therapy students safe patient transfer techniques use traditional didactic interventions such as lecture, peer demonstration and peer practice. However, these methods do not accurately portray full physical dependency or medical instability. Simulation technology allows for imitation of the clinically complex conditions found with medically fragile patients. Practicing within an authentic environment specifically addresses the complexities of transfer skills by creating realistic scenarios that allow students to apply what they learn without artificial translation (Resnick & Sanchez, 2009).

While high and low technology simulation is widely used to teach medical emergency and surgical procedures, it is also being used to educate students in critical clinical thinking (Kneebone et al., 2007; Lasater, 2007). In the healthcare professions, simulation has been used to teach motor skills, such as invasive procedural tasks like intubation, injection and catheterization. There is less application of simulation to teach skill acquisition beyond motor skill development (Lasater, 2007). However, the application of simulation to a range of motor skills across multiple healthcare professionals is limited. Within the nursing profession, simulation has been used effectively to teach patient transfer skills (O'Donnell et al., 2010), but there is currently no wide spread program to promote the effectiveness of simulator use to teach patient transfer skills in a rehabilitation curriculum (Nehring & Lashley, 2009).

Simulation promotes learning by promoting self-evaluation and eliciting feedback to emphasize decision-making skills (Lasater, 2007). Cognitive learning theory blends easily with simulation as an educational model because of simulation's strong environmental and behavioral foundation for learning. Cognitive learning theory's premise that function occurs as an interaction between cognition, behavior and the environment echoes simulation's unique approach to learning in which the learner is always dynamically interacting within an authentic environment (Anderson, Aylor, & Leonard, 2008; Docherty et al., 2005; Mann, 2002). Both self-evaluation and feedback are important constructs of cognitive learning theory related to self-efficacy. Self-efficacy plays a significant role in student performance and learning.

Self-evaluation and the result of previous experiences, both successes and failures, shape self-efficacy beliefs. Bandura posited that vicarious experiences also influence self-efficacy beliefs. These vicarious experiences are the social comparison and interpretation of the experiences of others who have been successful or unsuccessful in performing a specific or similar task (Bandura, 1997). Experiences, social comparisons, and effective teaching change self-efficacy beliefs. Positive social experiences can serve to promote positive self-efficacy beliefs (Bandura, 1997).

Self-efficacy has been used as a measure of performance in many fields, including work-related and organizational performance, academic achievement, behavioral changes, and athletic performance (Artino & McCoach, 2008; Ellis et al., 2010). Psychological, academic, and healthcare researchers assessing behavioral changes (Tam, 1996) have used measures of self-efficacy. Perceptions of self-efficacy are considered an important predicator of performance (Pike & O'Donnell, 2010). Self-efficacy has been identified as the best predictor of college grade point average, and among the best predictors to identify students who persist through college classes (Robbins et al., 2004). Bandura (1986, 1993, 1997) asserted that high self-efficacy beliefs would result in improved performance of any given activity. Many researchers have found a positive relationship between increasing levels of self-efficacy beliefs and performance outcomes (Bandura & Locke, 2003; Colquitt, LePine, & Noe, 2000; Salas & Cannon-Bowers, 2001; Stajkovic & Luthans, 1998).

Self-assessment and self-efficacy have been identified as essential for safe, effective clinical practice and are considered prerequisites for being an effective clinician. However, medical education literature indicates that individuals do not accurately assess their performance or the performance of peers (Redwood, Winning, & Townsend, 2010). While some researchers find that higher self-assessment and self-efficacy is associated with better performance (Colthart et al., 2008; Ellis et al., 2010), other researchers do not. Indeed, among healthcare professionals, self-efficacy beliefs do not consistently equate to task performance (Barnsley et al., 2004; Davis et al., 2006; Leopold et al., 2005).

2.7 THE IMPORTANCE OF ENVIRONMENT

Learning environment has been a recent focus in medical education. The Accreditation Council for Graduate Medical Education recommends the use of simulation to assess competence in medical procedure skills in the patient care domain. Health institutions have a limited capacity to offer quality-learning experiences, and this has resulted in a challenge to higher education to provide more clinical exposures in the current academic environment (Hutchings, Williamson, & Humphreys, 2005). Simulation is a means of heightening realism because of the accuracy with which it mimics the acute care clinical environment (Kneebone et al., 2007). Environment is especially important with hands-on procedures because tasks that are mastered easily in a generic environment, such as the classroom, may not be directly applied in a patient care environment, such as in an intensive care unit or at a patient’s bedside (Resnick & Sanchez, 2009). This may be due to a variety of factors, including time pressures, equipment differences, and visual and auditory distractions (Resnick & Sanchez, 2009). To be effective as a teaching method, simulation should reflect the technical performance of the learner in a realistic clinical environment (Kneebone, Kidd, & Nestal, 2005).

Simulation in an authentic environment can cover a broad spectrum ranging from providing the actual equipment to including the opportunity to respond to unanticipated complications requiring spontaneous decision-making or teamwork (Kunkler, 2006). The term fidelity is often used within the simulation literature to specify the match between the realism of the simulation and an actual clinical situation (Issenberg et al., 2005; Kneebone et al, 2007; McGaghie et al, 2010). On one end of the spectrum, simulated environments can be limited to the procedure itself, such as use of a task-trainer to learn to suture or to catheterize on a molded model. At the other end of the spectrum, simulated environments can extend to a mock operating room or disaster scenes. This helps students learn to make real-time decisions with appropriate visual, spatial, and auditory feedback (Issenberg et al., 2005; Kneebone et al., 2007; McGaghie et al., 2010).

Simulation situations designed to teach only specific procedures within a static environment have been criticized for not taking advantage of the unique environmental aspects available with simulation. They purportedly teach tasks only, and do not relate these tasks to the clinical environment (Kneebone et al., 2004). This focus on procedural tasks emphasizes the acquisition of motor skills and dexterity, and not overall performance (Kneebone et al., 2010). Learning through simulation offers the advantage of skill assessment beyond simply demonstrating technical proficiency. Simulation, when used to its full capabilities, can assess competence in procedures and techniques embedded in realistic clinical environments (Morton, Anderson, Frame, Moyes, & Cameron, 2006).

Kneebone et al. (2003) have noted that skills obtained through simulation of isolated task components deteriorate when these same medical procedure tasks are performed within a simulated clinical setting. The effects of anxiety, the need to make quick decisions and identify complications while in a distracting environment are likely to contribute to this deterioration. For maximum benefit the simulated learning situation should require the use of knowledge and multiple procedural skills, effective problem solving, and prompt decision making (Fisher, Ormonde, Riley & Lawrence, 2010). The ability to think critically and strategize in an appropriate environment while improving procedural skills is a unique contribution to learning offered with simulation (Fisher et al., 2010). Full environmental simulation includes orientation practices, as well as proficiency training and exposure to patient care skills. The learner is in an environment that mirrors clinical experience, which aids in transition to actual clinical practice (Fernandez et al., 2010).

Environmental factors are an important aspect to learning. A dynamic component of the learning experience is the situation or environment that a student is exposed to during learning (Martin, 2009). As Martin states, "Even small situational problems…can constitute critical aspects in learning a task" (p. 133). Recognizing this, some nursing and medical school programs have used high fidelity simulators placed within the real clinical environment. This use of simulation allows students a safe opportunity to practice techniques in an actual clinical setting. Therefore, there is no adaptation of the skills learned. These experiences have had positive learning results. In locations where full simulation centers that provide mock clinical care environments are not available, the use of high fidelity simulators placed within the actual clinic is also cost effective (Fernandez et al., 2010; Kneebone et al., 2005; Paige et al., 2009).

The use of simulation as a teaching method allows for manipulation of important environmental constructs. For example, the amount of time a learner has to complete a task or the multiple-roles a student can and must play during an event, especially if their role requires them to coordinate multiple team members for efficiency and success. In addition, simulation still provides a direct exposure to the physical tools used and the roles played by each active participant. As Hoffman and Donaldson (2004, p. 449) state, “People learn not *from* experience, but *in* it….”

2.8 PARTICIPATION AND OBSERVATION

Learners are active constructors of knowledge (Billett, 2000). An important consideration for an effective simulation program is the use of reproducible, standardized experiences where learners are active participants, not passive bystanders (Issenberg et al., 2005). Research suggests that the use of deliberate, repetitive practice with targeted performance and meaningful feedback assists in acquisition of clinical expertise (Cato & Murray, 2010). Participation in work tasks is valued as an aspect of learning (Billett, 2000; Lofmark & Wikblad, 2001). In a systematic review of 109 studies, Issenberg et al. (2005) found that 39% of the articles reported that repetitive practice is a key feature of simulation in medical education. Furthermore, activity-based learning is most effective in increasing knowledge when students have opportunities to apply what they have learned in more than one type of situation (Bluestone, 2007).

However, observation has also been touted as an important and effective method of learning. Grealish and Ranse, (2009) found that participation or observation of a task is a learning trigger for students. Imitation and emulation of motor tasks, or copying the actions of others, has also been called observational learning (Hodges, Williams, Hayes, & Breslin, 2007). This type of learning includes both a motor and a cognitive component (Hodges et al., 2007). The observer uses information based on the, “…context, difficulty, and novelty of the task” (Hodges, et al, 2007, p. 531). Even with specific task dynamics, such as using a new tool or piece of equipment that requires motor skills to explore the environment, in many cases the value of pure observation rivals the motor learning gained with unguided physical practice (Vogt & Thomaschke, 2007).

Cognitive learning theory proposed by Bandura (1984) substantiates the value of both participation and observation. This theory incorporates both observation and participation constructs. Enactive learning is the active mastery of a task or behavior. It is captured with direct participation, and allows for the repetition needed for mastery. Enactive learning recognizes that learning experiences result in an understanding of the consequences of the student’s actions. Enactive experiences are direct and active learning experiences. This is in contrast to an observational experience, which is a vicarious experience in which the student is only an observer and does not actively participate. Observational experiences are important because they allow a learner to consider the consequences of others’ actions, and provide a learning opportunity in all situations, even when it is not possible for each individual to be an active participant.

Both enactive and observational learning experiences contribute to the development of self-efficacy. While enactive experiences provide opportunities to examine the direct results of one’s behavior, observational experiences allow a vicarious examination from the results of others’ behavior. Enactive experiences are more powerful in increasing self-efficacy, but students cannot always be active participants in every learning experience. Therefore, observational learning is also important (Bandura, 1997).

2.9 SIGNIFICANCE

More research is required to determine the academic and clinical utility of simulator training for patient handling (Resnick & Sanchez, 2009). Simulation is viewed as an educational method that can safely reduce errors and adverse events (Christensen, Heffernan, & Barach, 2001; Rothgeb, 2008). However, the superiority of simulation over other teaching methods, such as lecture, laboratory sessions, and mentored groups, has not yet been established (Alinier, Hunt, Gordon, & Harwood, 2006; Kunkler, 2006; Schwartz et al., 2007; Wenk, et al., 2009).

This project seeks to explore the relationship between self-efficacy, learning and simulation technology, while teaching students to safely transfer medically fragile and clinically complex patients. Although many studies can be found that examine learning and self-efficacy, (Bandura, 1996; Santiago & Einarson, 1998; Schunk, 1989; Vancouver & Kendall, 2006), few have linked these relationships to either simulation (Bambini, Washburn, & Perkins, 2009; Nishisaki et al., 2007) or patient handling (Johnsson, Kjellberg, & Lagerström, 2006). Information about student learning is valuable for curriculum development and distribution of academic resources, such as laboratory fees and faculty and student time. In addition, exploring the relationship between self-efficacy and performance as it relates to patient transfers may assist in identifying students at risk for future problems in this area, which would then guide the design of interventions to promote competency. Academic interventions targeting clinical competency have the potential to decrease patient injury.

3.0 CRITICAL EVENTS EMBEDDED IN PATIENT HANDLING SIMULATIONS: BED TO WHEELCHAIR TRANSFERS

3.1 INTRODUCTION

For medical professionals patient handling requires skill to transfer the patient from one place to another as well as skills to manage any consequences of this whole body movement (Nelson et al., 2003). This is especially true in an acute care setting, where successful completion of a patient transfer involves both the procedural, hands-on skill of the transfer as well as management of a medical situation. Manual patient handling can be a high-risk activity due to the potential for harm and injury to both the patient and the healthcare professional completing the transfer (Nelson et al., 2003; Waters et al., 2009).

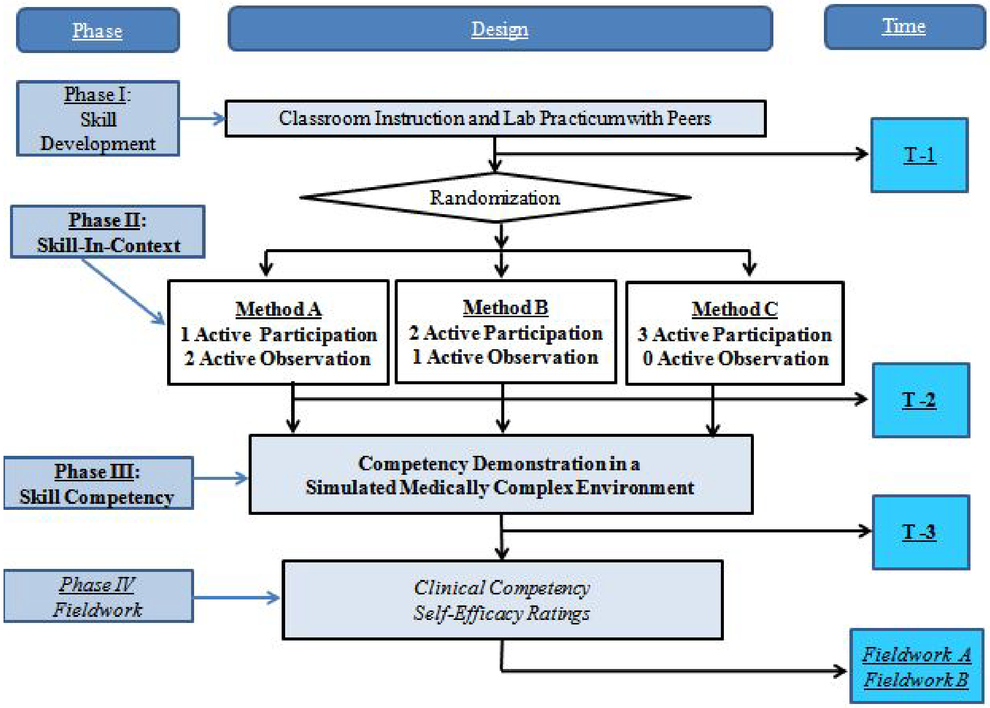
Simulation is especially suited to teach patient transfer skills as it has multiple advantages over other educational methods, including preservation of patient safety (Christensen et al., 2001; Rothgeb, 2008) and the ability to replicate clinical situations repeatedly (Isenberg et al., 2005; Lammers et al., 2008). Simulation also offers an authentic environment that reflects the complexities of patient transfer situations (O'Donnell et al, 2011). Because the simulation environment is realistic, students are often able to transfer what they have learned to the clinical environment with greater ease (Resnick & Sanchez, 2009). In addition to its ability to preserve safety and provide a viable learning medium, simulation addresses the procedural or task skills and the critical thinking skills needed for successful completion of a patient transfer in an acute care setting. Simulation is used widely to teach procedural or task specific skills (McGahie et al., 2010). It is also used to educate healthcare professionals in critical clinical thinking (Kneebone et al., 2007; Lasater, 2007).

Literature describing simulation to teach procedural skills seldom addresses patient handling specifically (Nehring & Lashley, 2009). In addition, those articles that do discuss patient handling and transfers focus on learning outcomes and not the teaching methods used to promote effective patient transfer skills (Lasater, 2007). This article describes the development process for creating realistic acute care transfer scenarios. The scenarios are unique in several ways. First, they are designed to assess patient handling skills in a realistic acute care environment. Second, they not only assess performance of the transfer procedure, but they also include a critical medical event embedded within each scenario. Finally, each scenario is designed to assess critical clinical thinking in response to a realistic acute care critical event.

3.2 METHODS

The scenarios were designed as part of an Innovations in Education grant to evaluate the best combination of active participation and observation using simulator mannequins to teach bed to wheelchair transfers of medically complex and fragile patients in an acute care environment. The scenarios were designed for use at the Peter M. Winter Institute for Simulation Education and Research (WISER). Students enrolled in the Master of Occupational Therapy (MOT) and Master of Science with a concentration in Occupational Therapy (MS) curricula participated in the WISER scenarios as a supplement to peer practice in a classroom laboratory.

The project was set up in four phases (see Figure 3.1). Students first completed classroom laboratory practice with colleagues, then attended WISER for additional training. Students returned to WISER for the competency assessment phase of the project. During all three phases (both the classroom laboratory and the WISER experiences), students were videotaped for later review by instructors and students. This was to allow for the undistracted assessment by the instructors and self-directed learning by the students. During phase three, scenario performance scores determined competency. After their WISER experience many students went on to complete their clinical fieldwork training (Phase IV).



Setting: Classroom = regular type. **WISER = bold type.** *Clinical Fieldwork = italics.*

Figure 3.1 Scenario Development Project Design

3.2.1 Participants

University of Pittsburgh Medical Center occupational therapists employed in acute care settings nominated common situations they faced when transferring medically fragile patients. Some examples were appropriate respiratory management, correct positioning of external lines, drains and tubes, and proper and timely notification of nursing with signs of medical instability. Following scenario development, participants included faculty and students of the Department of Occupational Therapy. Faculty members and doctoral candidates in the Department of Occupational Therapy at the University of Pittsburgh contributed to the scenario reviews to determine validity. Students enrolled in the graduate Occupational Therapy programs at the University of Pittsburgh participated in WISER scenarios and surveys to determine their perceived effectiveness.

3.2.2 Instruments

All scenarios centered around a “clinical challenge” --- an acute care bed to wheelchair transfer task required for the patient to complete a functional task. The functional tasks were appropriate to the level of medical stability, such as getting out of bed to complete oral hygiene or a basin bath. Each scenario was set in the same simulated environment (an acute hospital setting), and each scenario included a medical challenge, a clinical challenge, and a critical event.

Acute care setting routines, common medical situations, and common medical equipment and physical conditions guided development of the scenarios and the accompanying performance criteria. Specialized equipment or situations requiring a high degree of clinical expertise and management, such as mechanical ventilation were not included, as these patients are often not medically stable enough to move out of bed manually.

As one of the goals for scenario use was promotion of critical thinking, each scenario had an embedded critical event. The critical event for each scenario was different and was based on the medical challenge associated with that scenario. For example, in the intravenous (IV) scenario, the medical challenge is management of an antecubital IV line. The subsequent critical event is completing the transfer without disruption of the delivery of the IV medication. To do this the student had to correctly unplug the IV pump, move it to the transfer side of the bed and then complete the transfer without dislodging the insertion of the IV. The scenarios, along with their medical challenges and clinical challenges for each critical event are listed in Table 3.1.

Table 3.1 Scenario Description

Scenario	Medical Challenge	Clinical Challenge	Critical Event
Post-operative	Manipulation of Jackson-Pratt drain	Transfer out of bed into wheelchair to dress	Disconnection & reconnection of the reservoir that allows for gravity assisted drainage
Cardiac	Unforeseen episode of bradycardia	Transfer out of bed into wheelchair to bathe	Recognizing and managing the signs of bradycardia by calling for help
Pulmonary	Transfer from wall oxygen to portable oxygen tank	Transfer out of bed into wheelchair to groom	Disconnection and reconnection of oxygen sources
Chronic Medical	Unforeseen postural hypotensive episode	Transfer out of bed into wheelchair to groom	Recognizing and managing the signs of postural hypotension
Respiratory	Tracheostomy with oxygen and humidification	Transfer out of bed into wheelchair to dress	Maintaining a patent airway without allowing water to enter the tracheostomy or disconnection of the oxygen
Urinary	Catheter bag hooked to non-transfer side of bed	Transfer out of bed into wheelchair to dress	Moving the catheter bag to the wheelchair frame below the level of the bladder
IV Management	Antecubital IV line and pole	Transfer out of bed into wheelchair to groom	Maintaining a patent IV site and lines; not unplugging anything but the IV pump
Orthopedic Trauma	Left arm in sling Right leg casted	Transfer out of bed into wheelchair to bathe	Maintaining proper weight bearing precautions

Every scenario had a criterion based performance assessment form used by raters to quantify student performance. To promote consistency each performance assessment had the same number of criteria. The assessment rubric echoed the construction of the scenarios with some criteria addressing the procedural skill of managing the bed to wheelchair transfer and other criteria targeting management of the critical event.

Therefore, as the procedural skill and setting for each scenario was the same (bed to wheelchair transfer in an acute care environment) the 14 criteria used to assess management of the procedures of each aspect of the bed to wheelchair transfer were the same for each performance assessment. The 14 transfer task criteria were criteria needed to fully develop the flow of a patient encounter. These included basic infection control, equipment management (wheelchair and electric bed), and patient management (noting and recording monitored vital signs before and after the transfer). Next, criteria for the patient transfer process were developed and divided into specific components that involved body mechanics and safety (for the patient and the student) and preparation of the patient for the upcoming move out of bed. For consistent assessment of performance, operational guidelines for the 14 criteria for management of the patient encounter and the transfer were developed. Table 3.2 lists the 14 criteria along with their operational guidelines.

Table 3.2 Procedural Assessment Criteria and Operational Guidelines

	Procedure	Goal	Evidence
1	Hands are washed.	Proper infection control procedures are followed	Observed washing hands on video or auditory evidence of water running.
2	Vital signs are recorded at start of session.	Monitoring of medical stability	Blood pressure, heart rate, respiratory rate, and oxygen saturation are completely and accurately filled in on student's lab sheet.
3	W/C is positioned as close to the bed as possible.	Patient & therapist safety	Side of W/C is next to electric bed with no significant gap.
4	W/C brakes are locked and W/C stability is checked prior to beginning transfer.	Patient & therapist safety	Locking of brakes is observed on video, W/C remains in place when pushed/pulled.
5	Leg rests and armrests are removed or swung out of the way.	Patient & therapist safety	Armrest and legrest between simulator and W/C seat are removed.

Table 3.2 (continued).

	Procedure	Goal	Evidence
6	Clear directions regarding patient's role in transfer are given.	Patient & therapist safety	Participant explained to patient that he/she would be assisted to sit on edge of bed and then assisted into a wheelchair in preparation for activity.
7	Patient is moved supine to sit safely.	Patient & therapist safety	Done with elevation of the head of the bed, or safe manual handling techniques. Participant hand placement could not be around the neck.
8	Bed height is adjusted to allow the patient’s feet to touch the floor.	Patient & therapist safety	Both feet must touch the floor and the entire foot, including heel must touch the floor.
9	Upright posture of the patient is supported by using proper hand placement that prevents a loss of balance on the edge of the bed.	Patient & therapist safety	Hand placement near scapula and below cervical spine. Hand placement could not be around the neck. Patient could not evidence a loss of sitting balance.
10	Patient is scooted to edge of bed with buttocks remaining on mattress.	Patient & therapist safety	Hips moved contralaterally in a controlled manner. Patient’s arms must remain at rest in a normal position and could not get caught on the bed/sheets. Patient must stay on edge of bed and could not slide off edge of mattress.
11	Movement from bed to W/C is smooth and controlled, with no jarring or sudden movements.	Patient & therapist safety	Movements must be coordinated and controlled. Transfer could not be paused midway.
12	Proper body mechanics are used during transfer (back straight, knees bent, head erect).	Patient & therapist safety	Proper body mechanics observed on video (back straight, knees bent, head erect). The patient must have weight shifted and could not be lifted or supported in a standing position.
13	Legrests and armrests are replaced to original position.	Patient & therapist safety	Armrests at side of wheelchair. Legrests observed locked with footplate fully down and patient’s feet on them; armrest secure in wheelchair frame.
14	Vital signs are recorded at end of session.	Monitoring of medical stability	Blood pressure, heart rate, respiratory rate, and oxygen saturation are completely and accurately filled in on student’s lab sheet.

Note. W/C = wheelchair.

Because each scenario had a different critical clinical event the criteria used to assess management of the critical event were unique and not duplicated among scenarios. Each critical event yielded four rating criteria (see Table 3.3).

The 14 procedural criteria and the four critical criteria were combined for a total of 18 overall performance criteria. Each criterion was rated as being achieved or not achieved. One point was given for each criterion a student met. Therefore, for each scenario the highest score possible was 18. Appendix A includes the vignettes and scenario performance assessment forms.

Table 3.3 Critical Event Criteria

Scenario Critical Event and Operational Criteria
Post-operative: Objective - Maintain integrity of Jackson-Pratt drain
-Drain is unclipped from bed linens prior to any patient movement.
-Drainage clip/safety pin is moved to gown while transferring patient.
-Drain and tubing are kept slack/loose (are not pulled/do not become taut).
-Drain is pinned below the level of insertion to allow for gravity assisted drainage.
Cardiac: Objective - Recognition and management of bradycardic episode
-Notes that vital signs are not stabilizing.
-Nurse is called.
-The change in patient condition is calmly and accurately reported over the call system.
-The patient is reassured that the nurse is being called.
Pulmonary: Objective - Correct transition from wall oxygen to portable oxygen tank
-Portable oxygen tank is placed next to wheelchair/in holder in preparation for transfer.
-The disconnection/reconnection of oxygen is explained without jargon, BEFORE the transition.
-Portable oxygen tank liters per minute are adjusted to match wall oxygen liters per minute.
-Patient’s oxygen access is disrupted for less than 60 seconds.
Chronic Medical: Objective - Recognition and management of postural hypotension
-Head of patient is elevated slowly.
-Observation of vital signs as head of patient is elevated.
-Elevation is stopped until vital signs become stable again.
-Scanning of monitors visually for vital signs as the patient is brought to full upright position.
Respiratory: Objective - Management of humidified airway with tracheostomy
-Water is distributed back into reservoir/onto washcloth before patient movement.
-No water is allowed to enter the airway through the tracheostomy.
-Oxygenated airway patency is maintained during transfer (tubing does not become dislodged).
-Oxygenated airway tubing is kept slack/loose (is not pulled taut).
Urinary: Objective - Management of urinary catheter bag
-Catheter bag is unhooked from bed frame and moved to transfer side of bed.
-Catheter bag and tubing are kept slack/loose (are not pulled/do not become taut).
-Catheter bag is immediately repositioned under wheelchair after patient transfer is complete.
-Tubing is checked to assure full drainage into catheter bag (tubing is not kinked or twisted).
IV: Objective - Management of antecubital IV
-Only the IV pump is unplugged (hands are walked backward from the IV pump to the plug).
-IV line is protected by moving the pole around the bed in a controlled manner prior to transfer.
-The IV pole/pump are out of the way and do not present a physical barrier during the transfer.
-IV site integrity is maintained (the IV line remains intact and is not dislodged or disconnected).
Orthopedic: Objective - Mantaintance of non-weight bearing precautions
-Sling is positioned correctly before the transfer (strap is not twisted, elbow into the sling, wrist and hand supported)
-Upper extremity is kept in sling and remains protected during transfer with no hand placement in/around left axilla)
-Upper extremity remains immobilized with no weight bearing or external pressure
-Sling is positioned correctly after the transfer (strap is not twisted, elbow into the sling, wrist and hand supported)

3.2.3 Procedures

Students were required to engage in a patient encounter at WISER using SimMan®. The vital sign software was used but the interface was disconnected to avert damage to the equipment during the transfer. All scenarios were completed in a medical theatre room consisting of an electric hospital bed, sink, bedside stand, wall monitor, and wheelchair. An instructor, behind one-way glass, managed the scenario from a control room.

A brief vignette outlining the medical condition and clinical challenge was given to the student prior to engagement in the simulation. Students were provided with a paper grid to record vital signs pre- and post- transfer. A list of instructions to set-up equipment and supplies between each transfer ensured that the simulation and medical theatre rooms were reset the same way before each transfer. Each student had 10 minutes to complete the transfer. All sessions were videotaped and timed. At the end of 10-minutes the session was halted, even if the transfer was not complete.

Scenarios addressed three different themes: (a) management of a line, drain or tube, (b) management of respiratory equipment, and (c) management of a decline in medical stability. For example, three scenarios were designed to challenge the ability of the student to maintain the integrity of an invasive line while completing a transfer. The Urinary, IV and Post-operative scenarios required management of a line, drain or tube (theme a). Two scenarios were designed to assess effective management of hospital-based technologies and equipment. The Pulmonary and Respiratory scenarios required the use of wall oxygen and adjustments to this type of equipment (theme b). Two scenarios used the high technology software programming available with the simulator. Both the Cardiac and the Chronic Medical scenarios used software that allowed the simulator to respond to student interventions (theme c). The Chronic Medical

Scenario software program allowed a voice recording stating, “I’m dizzy.” This was activated when the head of the simulator was elevated. If the elevation was not slowed, blood pressure was decreased steadily. In the Cardiac scenario the simulator was programmed to evidence a continuous decrease in heart rate that began when the simulator was in the wheelchair. The heart rate was programmed to slow to 40 beats per minute, which required the student to use the nurse call system to alert unit staff of this change in medical status.

All sessions were digitally recorded. The scenarios were scored by video review using the performance assessment form, which evaluated the students’ ability to follow sequentially the tasks to complete a safe transfer. Review of student performance during the first WISER experience was completed prior to the second WISER experience, and review of the second WISER experience was completed prior to engagement in clinical fieldwork. Assessors were masked to the purpose of the study as well as student group assignment. Individual feedback was given to each student on the performance assessment forms. Group feedback, focusing on the most common errors (e.g., difficulty with equipment management or forgetting to record vital signs post-transfer), was also provided.

3.2.4 Data Analysis

To evaluate the validity of the scenarios, faculty members and doctoral students assessed four constructs: ecological validity, safety, use of equipment and technology, and complexity. The mean overall rating of the scenario determined final inclusion in the study. To test overall level of difficulty, student performance scores were obtained. A comparison of mean averages, standard deviations and minimum and maximum scores assured that scenarios were of comparable challenge. To determine scenario effectiveness, as defined by participants, students were surveyed after each phase of the project. The mean averages and minimum and maximum scores were compared to determine if the scenarios were perceived as effective for clinical preparation to transfer real patients.

3.3 RESULTS

The scenarios were used as part of a larger study to determine the effectiveness of simulation training that included observation and participation components for students. They were rated first to ensure that they demonstrated validity. Then the scenarios were used in the simulations, where student performance and perceptions were assessed.

3.3.1 Validity

Before use at WISER, the scenarios were peer-reviewed to determine their validity. Reviewers were five faculty members and three doctoral candidates in the Department of Occupational Therapy at the University of Pittsburgh. All reviewers had experience in direct patient care and exposure to intervention in the acute care environment. Ratings for four constructs were obtained: (1) the ecological validity of each scenario, (2) the degree to which each scenario assessed patient and therapist safety, (3) the degree to which each scenario assessed equipment and technology management/use, and (4) the overall complexity of each scenario. All ratings used a scale from 1 through 10, with 1 being the lowest rating and 10 being the highest rating (see Table 3.4). The seven scenarios with the highest mean average rankings were used in the study. The orthopedic trauma scenario was not used due to low ratings of ecological validity and low overall ratings.

Table 3.4 Critical Event Scenario Ratings

Scenario	Ecological Validity	Safety	Use of Equipment & Technology	Complexity	Scenario Mean
Post-Operative	9.25	9.29	8.13	3.75	7.60
Cardiac	9.00	9.63	7.50	7.63	8.44
Pulmonary	9.38	9.50	8.75	6.88	8.63
Chronic Medical	9.50	9.63	7.63	5.88	8.16
Respiratory	9.38	9.38	8.13	5.38	8.06
Urinary	9.25	9.75	9.13	5.75	8.47
IV Management	9.25	9.75	9.50	6.88	8.63
Orthopedic	7.88	7.88	7.13	3.63	6.63

Note. Scale = 1 (low) to 10 (high).

3.3.2 Parallel Construction and Level of Difficulty

The scenarios were designed to have equivalent levels of difficulty and to address different but similar medical situations so that they could be grouped by similarity or stratified to provide different types of experiences. Performance assessment scores were averaged to ensure that the scenarios were of comparable difficulty. The Cardiac scenario appeared to be the most challenging for students, while the IV scenario appeared to present the least difficulty. Student performance scores are listed in Table 3.5.

Table 3.5 Scenario Performance Scores

	N	*M*	*SD*	Minimum	Maximum
Post-operative	73	72%	16%	5%	94%
Cardiac	73	66%	15%	16%	94%
Pulmonary	72	71%	14%	22%	94%
Chronic Medical	52	83%	9%	55%	94%
Respiratory	54	81%	9%	50%	94%
Urinary	53	82%	10%	50%	94%
IV	49	88%	7%	72%	100%

Note. *M* = mean; *SD* = standard deviation.

The students also assessed their own experiences with the scenarios. They had the opportunity for multiple exposures to the scenarios at WISER prior to beginning their fieldwork internships. Students were surveyed five times--prior to beginning simulation training, after their first exposure to simulation, after their second and last simulation exposure, after their first clinical fieldwork, and after their second and last planned clinical fieldwork. They were asked to rate the effectiveness of this simulation training and the scenarios on a scale from 1 to 10. A score of 1 indicated that they were very uncertain that the experience was effective while a score of 10 indicated that they were very certain that the experience was effective. The results are listed in Table 3.6.

Table 3.6 Scenario Effectiveness

How certain are you that the Wiser Center simulation experience will be /was effective for preparing you to transfer medically fragile and clinically complex patients?				
	N	*M*	Minimum	Maximum
		WISER		
Before Use	106	8.81	4	10
After First Experience	108	8.01	2	10
After Second Experience	109	7.98	1	10
		Clinical Fieldwork		
Fieldwork A	44	7.07	3	10
Fieldwork B	42	6.93	2	10

Note. M = mean; Scale = 1 (very uncertain) to 10 (very certain).

Overall students indicated that the scenarios and simulation experience were effective in preparing them to transfer medically complex patients in an acute environment. Simulation scenario effectiveness decreased when exposure to the actual clinical setting increased.

3.4 DISCUSSION

These transfer scenarios addressed multiple needs. Students expressed a need for more intensive practice completing dependent patient transfers. Clinical fieldwork educators requested that students have more exposure to critical events that would promote critical reasoning skills. Acute care therapists working in hospitals, transitional care, skilled nursing, and inpatient rehabilitation settings wanted curriculum content that addressed practical, hands-on management of common clinical conditions and associated medical equipment. Simulation provided the ideal means to address all these needs while preserving patient safety.

Usual teaching practices exposed students only to a peer transfer in a classroom laboratory before clinical practice with actual patients. With the use of the simulation scenarios, students were exposed to true dependent transfers, a mock acute care environment, medical equipment and conditions, and critical events requiring critical reasoning. The scenarios achieved these clinical aims within a framework that supported student learning. A major advantage of simulation is that students experience the consequences of their actions (e.g., a poorly executed transfer results in a fall; mismanagement of an invasive line, drain or tube results in observable injury).

Scenarios allowed students to learn to replicate best clinical practice. Each scenario involved the same procedural task, a bed to wheelchair transfer, while providing a different type of critical clinical event. Each performance assessment form reflected the steps a student should take over the course of the patient encounter, in sequential order. The performance criteria began with hand washing, assessment of vital signs, and equipment management; transfer steps and clinical responses were listed in the order in which they usually occur. This helped the students to establish good habits for clinical practice.

Except for a few, most of the students responded positively to the scenarios, recognizing the realism of the simulations. Student feedback about the WISER experience was formally solicited during clinical fieldwork experiences. When asked about their WISER experiences in relation to classroom-based learning one student commented, “While not perfect, I still think WISER transfers were better than nothing–just hearing about IVs, trachs [sic], oxygen lines is easy compared to actually having to figure out what to do with them during a transfer.” Another student wrote, “Some things just cannot be taught in the classroom. It takes repeated exposure in a clinical setting to begin to develop confidence…. The WISER was a great introduction so that I didn’t feel like I was going in [to my clinical fieldwork] blind.”

While the scenarios had learning benefits, they also had teaching benefits. The sequential organization of the performance criteria resulted in the efficient assessment of the students’ performance during each scenario. Using the same performance criteria for the transfers provided a consistent format for assessment and guided instruction. The performance assessment form provided formal, objective feedback to the instructors about areas that needed additional instruction. For example, if multiple students’ evidenced difficulty with a specific skill set such as one aspect of equipment management, those skills could be re-taught, either in the classroom or by a digital video review.

These scenarios took advantage of WISER high-technology simulation by using monitors programmed to mimic and adjust vital signs. However, with the exception of the Cardiac scenario that took advantage of the patient monitor to reflect an episode of bradycardia, and the Chronic Medical scenario that used the patient monitor to reflect postural hypotension, the same scenarios could also be used to assess student performance in a low-technology simulation situation. These scenarios can be easily recreated without sophisticated technology, thus reducing cost. The only equipment needed would be a full-sized mannequin, a wheelchair and a hospital bed, plus the additional supplies specific to that scenario (e.g., a Jackson-Pratt drain for the Post-operative scenario, or a portable oxygen tank for the Respiratory scenario).

The transfer scenarios centered around the need to create safe teaching and learning situations that highlighted transferring of clinically complex and medically fragile patients in an acute care environment. The scenarios reflected current practice and highlighted basic equipment and medical management issues. Exposure to multiple scenarios also addressed the need for practice of clinical procedural skills and attention to safety behaviors. They provided reproducible situations with immediate consequences that promoted student learning and made instructor assessment and remediation easier.

Although simulation is most often used for urgent and emergent care training, the use of simulation scenarios with embedded critical events was effective for teaching and assessment of transfer skills for occupational therapy students. This training occurred in a realistic context and without risking injury to clinically complex and medically fragile patients. Students also reported that the scenarios were effective for learning, and that their learning experience was broader than just transfer training. The advantages of simulation were fully utilized to teach students about the importance of monitoring vital signs, managing equipment, adjusting to the acute care environment, all while implementing the mechanics of the transfer.

3.5 LIMITATIONS

While the scenarios were effective as a means for teaching transfer skills to students in a simulated setting, there were limitations. The simulators weighed between 65 and 75 pounds, which is less than the average weight of an adult. In addition, the center of gravity of the simulator was in the upper body (chest and abdomen) which is not consistent with a human patient.

The scenarios took place in a medical theatre room that mimics a hospital or acute care setting. However, there was only one bed in this room and little additional furniture, making it possible to maneuver the wheelchair and other equipment, such as the portable oxygen tank, without needing to move around other furniture or people.

Often medically complex patients have multiple co-morbidities and these scenarios only included one medical condition, not multiple conditions. Although this allowed the student to address one condition for ease of learning, in a clinical environment it may not be possible to address only one condition at a time with complex patients.

3.6 FUTURE RESEARCH

Suggestions for future study include further scenario development. Although seven scenarios were used, these scenarios are not representative of all medical conditions. Some common clinical conditions such as weight bearing precautions, range of motion limitations and neurological involvement were not represented.

Combining conditions as the student moves through training should also be explored. For example, patients often have IV lines and additional equipment, such as oxygen. A combination scenario using both the IV and respiratory criteria would challenge students to manage multiple conditions. Combining conditions and including management of a change in medical status would provide learning benefits and promote more advanced critical thinking.

Further analysis of the components of the performance assessments is also needed. The critical event criteria captured the student's response to an unexpected event and thus were reflective of their reasoning. Hence, further analysis of these criteria is warranted to provide insight into the learning mechanisms associated with these events that can be difficult to teach in a traditional classroom setting.

4.0 SIMULATION TO TEACH PATIENT TRANSFERS: THE ROLE OF SELF-EFFICACY

4.1 INTRODUCTION

Healthcare education aims to teach students to apply didactic knowledge to clinical situations. Therefore, opportunities for students to practice critical thinking, decision-making, and problem solving are especially valuable (Nehring, Lashley, & Elllis, 2002; Rothgeb, 2008). Simulation creates situations that mimic clinical reality and as such they assist the student to transfer knowledge to practice. Practicing within an authentic environment specifically addresses the complexities of learning to safely handle and transfer medically fragile and clinically complex patients by creating realistic scenarios that allow students to apply what they learn without artificial translation or risk to a real human patient (Resnick & Sanchez, 2009). Simulation also promotes self-evaluation and provides instant feedback to emphasize decision-making skills (Lasater, 2007). These characteristics make it a powerful educational tool.

However, the use of simulation within a realistic environment is not without controversy. First, simulation is not always available (Stevens et al., 2006). In addition, simulation used in medical education has been criticized as not allowing the student to be able to generalize learned techniques or increase competence (Châtenay et al., 1996; Jolly et al., 1996; McManus, Richards, Winder, & Sproston, 1998; Morgan & Cleave-Hogg, 2002). Finally, the high cost of simulation technology is also a drawback for its use (Stevens et al., 2006).

Cognitive learning theory fits well into simulation as a teaching technique. In both simulation and cognitive learning theory there is a strong emphasis on the learning environment (Bandura, 1977, Issenberg et al, 2005; Kneebone et al, 2007; McGaghie et al., 2010). Both simulation and cognitive learning theory emphasize behavior and feedback as the basis for future learning (Bandura, 1984, 1977; Pike & O'Donnell, 2010). Both self-evaluation and feedback are important constructs of cognitive learning theory and are associated with self-efficacy, namely one's beliefs about one's ability to perform a defined task in a specific situation (Bandura, 1986) Therefore, self-efficacy plays a significant role in student learning and performance(Bandura & Lock 2003; Colquitt et al, 2000; Salas & Cannon-Bowers, 2001; Stajkovic & Luthans, 1998).

Bandura's cognitive learning theory states that learning occurs as an interaction between cognition, behavior, and the environment (Bandura, 1984, 1977). This triangulation of learning factors echoes simulation's unique approach to learning in which the learner is always dynamically interacting within an authentic environment (Anderson, Aylor, & Leonard, 2008; Bandura, 1977; Docherty et al., 2005; Mann, 2002). Using cognitive learning theory as a framework, this study combined simulation with teaching methods that emphasized active participation, active observation and self-efficacy ratings to determine the most effective educational method for manual handling of clinically complex patients.

In addition to examining the association between ratings of knowledge self-efficacy, skills self-efficacy and safety self-efficacy at T2 and T3 with ratings of knowledge self-efficacy, skills self-efficacy and safety self-efficacy achieved during clinical fieldwork experiences, we hypothesized that:

- At T3 there would be no difference in knowledge self-efficacy, skills self-efficacy and safety self-efficacy for students assigned to teaching Methods A , B or C.
- There would be a significant decrease in levels of knowledge self-efficacy, skills self-efficacy and safety self-efficacy from T1 to T2.
- There would be a significant increase in levels of knowledge self-efficacy, skills self-efficacy and safety self-efficacy from T2 to T3.
- Student knowledge self-efficacy, skills self-efficacy and safety self-efficacy ratings at T1 would predict skill competency scores at Phase III.
- Student knowledge self-efficacy, skills self-efficacy and safety self-efficacy ratings at T2 would predict skill competency scores at Phase III.

This study sought to determine the effects of teaching method and time upon knowledge self-efficacy, skills self-efficacy and safety self-efficacy. It also explored knowledge self-efficacy, skills self-efficacy and safety self-efficacy as a predictor of performance. There were multiple data collection points, beginning with classroom instruction and followed by simulation experiences mimicking an acute care environment. The final data collection occurred after completion of clinical fieldwork (see Figure 4.1).

4.2 METHODS

4.2.1 Research Design

A randomized clinical trial design was used for this study. It was designed to capture the relationship between performance and self-efficacy beliefs. Each phase or time point contained one or more performance and self-efficacy assessments. The experiences had a common theme of patient handling or transfers. The patient transfer experiences covered a broad range of learning situations. The four phases in the study were associated with self-efficacy assessments. Data collected at the end of each phase included participants' knowledge self-efficacy, skill self-efficacy, and safety self-efficacy ratings (see Figure 4.1).

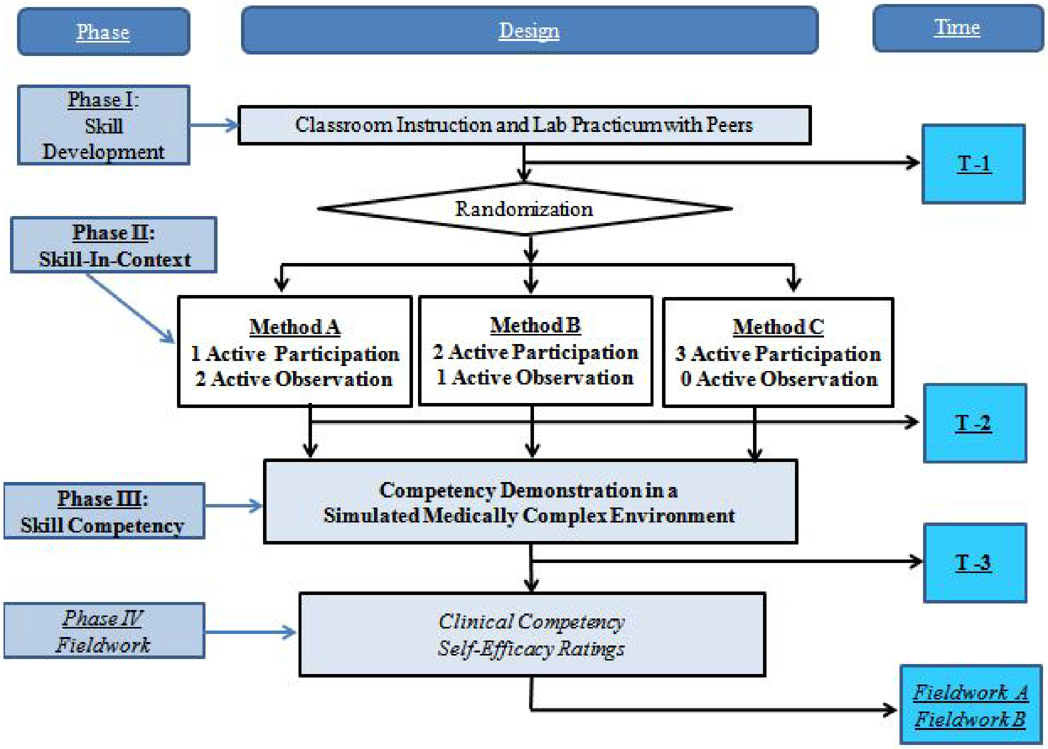


Figure 4.1 Study Design

In this study, traditional learning methods, including didactic presentations and peer-practice training in the classroom and laboratory, comprised the first type of learning experience. To begin the learning process, participants completed patient transfers in a familiar classroom and laboratory using peers. Next, participants experienced novel critical event scenarios that were simulator-based in a realistic, non-familiar, acute medical setting environment. The simulated patient care environment used exposed students to a patient room that mirrors an acute care setting, such as that found in a hospital, rehabilitation unit, or skilled nursing facility, locations where medically complex patients receive care.

Students were randomized to one of three combinations of active participation and active observation. Some students experienced only active participation, wherein the student completed three transfers, and had no opportunity to observe peers (Teaching Method C). In the remaining groups, students observed peers. One group had two opportunities to transfer a simulator and one opportunity to observe a peer (Teaching Method B). The other group had one opportunity to transfer a simulator and two opportunities to observe peers (Teaching Method A).

During this phase, students both participated and observed peers to determine how the use of more repetitive practice without opportunity for feedback through observation of others compared to less hands-on practice with more opportunity for feedback through observation of others. Activation of feedback mechanisms was through two different methods, active observation and active participation. Both are consistent with the social-cognitive theory (Bandura, 1997).

Formal, individual, scenario specific written feedback was provided and then group discussion of each simulation experience followed. Finally, the participants completed transfers with clients and patients during actual clinical fieldwork.

Using cognitive learning theory as a framework, we operationalized Bandura's vicarious experiences as active observation, and enactive experiences were operationalized as active participation. Feedback obtained through active observation contributes to one's social comparisons and interpretation of others' successes and failures. These comparisons represent an important source of self-efficacy information (Bandura, 1997; Schunk 1989; Schwartzer, 1992).

Another form of feedback was the formal objective performance assessment that was given to each student after all active participation experiences. These active participation experiences began with the initial laboratory practicum assessment wherein peers were transferred in a familiar academic environment. This was followed by the simulation based assessments used later in the study. After each manual handling experience in the classroom or within the simulation scenario, students were given formal feedback as a group on their performance. Because self-efficacy is based upon reflection of previous experiences, these formal assessments of performance contributed information to create self-efficacy beliefs based upon active participation (Bandura, 1997).

4.2.2 Participants

The participants were the first and second year Master of Occupational Therapy (MOT) students and Master of Science in Rehabilitation Science with a concentration in Occupational Therapy (MS) students at the University of Pittsburgh. MOT students enrolled in OT 2113: Rehabilitation Theory & Practice in 2009 or 2010 and MS students enrolled in HRS 2514: Rehabilitation Theory & Practice in 2010 were eligible. The University of Pittsburgh Institutional Review

Board approved this study, which was part of a larger study to determine the cost-effectiveness of simulation to teach patient handling.

4.2.3 Procedures

During Phase I: Skill Development, participants received classroom instruction and lab practice with peers. Lectures presented addressed the various types of patient transfers as well as the amount and type of assistance a patient may require. Students also received education about the intensive care unit, acute care settings, and management of lines, drains, tubes and respiratory equipment. A review of vital sign assessment and recognition of medical instability was provided. Also, body mechanics during transfer activities were reviewed. There was also discussion of the equipment available to aid transfers. Lecture included a step-by-step review of a dependent transfer and precautions. The participants completed a laboratory practicum in the classroom wherein they transferred peers to practice patient handling skills. Performance of the transfer was assessed using a 10-point checklist designed to capture adherence to proper patient safety and body mechanics procedures (See Appendix A). The transfer was videotaped.

After Phase I: Skill Development, participants completed self-efficacy ratings. This occurred before they received an academic grade or any feedback. Participants then received feedback through an academic grade including written recommendations to improve their performance. Participants were also given the opportunity to review videos of their transfer at this time.

During Phase II: Skill-In-Context, participants were randomly assigned to one of three groups. Each group had exposures to three clinical scenarios that involved a bed to wheelchair transfer with a *simulator* (SimMan®). This phase occurred at the Peter M. Winter Institute for

Simulation Education and Research (WISER) at the University of Pittsburgh. Each group experienced a different teaching method which combined active observation with active participation to determine what ‘dose’ of participation/observation resulted in the best learning outcome. Students randomized to groups A or B observed their peers and summarized their performance on a standardized checklist. This process fostered active observation.

Method A participants completed one hands-on transfer (active participation) and observed peers complete transfers during two additional scenarios (active observation). Method B participants completed two hands-on transfers (active participation) and observed a peer complete one transfer (active observation). Method C participants completed three hands-on transfers (active participation), and no active observations. Each of the transfers occurred in a different medical theatre room, with the same medical environment simulated. Each of the transfers was embedded in a different clinical scenario containing a different critical clinical event (see Table 4.1). All experiences were limited to 10 minutes, and all experiences were videotaped. A scenario manager employed by the Department of Occupational Therapy monitored each room. This manager was also responsible for setting and resetting the simulated patient rooms to specific standards between each participant so that all environmental factors were the same at the start of the experience.

After finishing the transfers and observations of Phase II: Skill-In-Context, participants immediately completed knowledge self-efficacy, skill self-efficacy, and safety self-efficacy ratings before leaving WISER. The participants received formal, individual performance feedback via a scenario performance assessment form for each hands-on, active participation experience. In addition, verbal feedback that addressed common problems was provided in a group setting, and time for questions and answers was included. All feedback was provided prior to Phase III. Students were offered the opportunity to review videos of their performance.

During Phase III: Skill Competency, participants again completed hands-on transfers (active participation) at WISER. Each participant completed two transfers in a different medical theatre room, within the same medical environment. Each of the transfers was embedded in a different scenario containing a new and different critical event. Participants were again randomly assigned to two scenarios from the four new scenarios created for this phase (see Table 4.1). The scenario managers were again responsible for setting and resetting the simulated patient rooms to specific standards between each scenario so that all environmental factors were the same at the start of the experience.

After Phase III: Skill Competency, participants immediately completed knowledge self-efficacy, skill self-efficacy, and safety self-efficacy ratings before leaving WISER. The participants received formal, individual performance feedback through a written performance assessment for each of the hands-on, active participation experiences. In addition, verbal feedback was provided in a group setting, and time for questions and answers was included. All feedback was provided prior to Phase IV. Students were also offered the opportunity to review the videos of their performance.

During Phase IV: Fieldwork, participants were asked to complete knowledge self-efficacy, skill self-efficacy, and safety self-efficacy ratings before leaving each of their 12-week Level II fieldwork experiences (Fieldwork A and Fieldwork B).

Table 4.1 Scenario Description

Scenario	Medical Challenge	Clinical Challenge	Critical Event
		Phase II	
Post-operative	Manipulation of Jackson-Pratt drain	Transfer out of bed into wheelchair to dress	Disconnecting & reconnecting of the reservoir that allows for gravity assisted drainage
Cardiac	Unforeseen episode of bradycardia	Transfer out of bed into wheelchair to bathe	Recognizing and managing the signs of bradycardia and calling for help
Pulmonary	Transfer from wall oxygen to portable oxygen tank	Transfer out of bed into wheelchair to groom	Disconnecting and reconnecting of oxygen sources
		Phase III	
Chronic Medical	Unforeseen postural hypotensive episode	Transfer out of bed into wheelchair to groom	Recognizing and managing the signs of postural hypotension
Respiratory	Tracheostomy with oxygen and humidification	Transfer out of bed into wheelchair to dress	Maintaining a patent airway without allowing water to enter the tracheostomy or disconnection of the oxygen
Urinary	Catheter bag hooked to non-transfer side of bed	Transfer out of bed into wheelchair to dress	Moving the catheter bag to the wheelchair frame below the level of the bladder
IV Management	Antecubital IV line and pole	Transfer out of bed into wheelchair to groom	Maintaining a patent IV site and lines; not unplugging anything but the IV pump

4.2.4 Descriptive Measures

Participant demographic information was collected from the records of the Department of Occupational Therapy. This information included: age, gender, type of program (MS or MOT), and year of academic progress.

4.2.5 Outcome Measures

Data were collected from assessments specifically designed for this study. To examine performance during transfer training at WISER, scenario performance assessment scales were developed. These assessment scales were based on prior instruments used to determine competency within courses in the Department of Occupational Therapy. To measure self-efficacy related to these experiences, knowledge self-efficacy, skills self-efficacy and performance self-efficacy scales were developed. Questions included: "How certain are you that you have the knowledge to transfer medically fragile and clinically complex patients?", "How certain are you that you have the skills to transfer medically fragile and clinically complex patients?", and "How certain are you that you can safely transfer medically fragile and clinically complex patients?"

The knowledge self-efficacy, skills self-efficacy and performance self-efficacy scales rating scales were patterned after existing self-efficacy scales. Self-efficacy scales are typically based upon subscales which are scored separately. Each subscale addresses a specific aspect of self-efficacy, and all subscales use a rating scale in increments of 10, such as a scale ranging from 1 through 10, or 10 through 100 (Lorenz, Gregory, & Davis, 2000; Lorig et al., 1989; Lorig

& Holman, 1993; Lorig & Holman, 1998). Questions were framed using the phrases “how certain are you that you can…”, or “how confident are you that you can…” (Lorig & Holman, 1998).

Because efficacy beliefs vary across domains of functioning (Bandura, 1997), measurement of these beliefs is task specific. Thus, for this study, self-efficacy was rated for specific academic and performance constructs, including knowledge, skills, and safety. Participants completed these rating scales after performance in each phase (see Appendix B).

Each of the three self-efficacy scales (knowledge, skills and safety) was rated, and no overall self-efficacy rating was obtained. Analyses were performed on each of these three scales; scores were not combined. All ratings were completed on a scale from 1 to 10 (1 = very uncertain and 10 = very certain).

Each student’s performance was digitally recorded and rated by a review of this recording. To assure scoring consistency, 10% of the scenarios during both Phase II (Skill-In-Context) and Phase III (Skill Competency) were scored first by all raters independently. These scores were then compared, and agreement regarding the nuances of each criterion was achieved before the remaining scenarios were scored. Table 4.2 lists each of the 14 criteria along with additional operational definitions used by the raters. Each criterion was either achieved or not achieved. Criteria that were met were given 1 point. For all assessments, the highest score possible was 18, which included four criteria designed to assess management of a critical event. Because each scenario had a different critical event, the criteria for each scenario were unique. The seven critical events, each with four specific criteria, addressed (1) maintaining the integrity of a Jackson-Pratt drain, (2) recognizing and managing a bradycardic episode, (3) transitioning an oxygen supply from the wall to a portable oxygen tank, (4) recognizing and managing postural hypotension, (5) managing a tracheostomy with a humidified airway, (6) managing a urinary catheter bag, and (7) managing an antecubital IV.

Table 4.2 Assessment Criteria Operational Definitions

	Procedure	Goal	Evidence
1	Hands are washed.	Proper infection control procedures are followed	Observed washing hands on video or auditory evidence of water running.
2	Vital signs are recorded at start of session.	Monitoring of medical stability	Blood pressure, heart rate, respiratory rate, and oxygen saturation are completely and accurately filled in on student's lab sheet.
3	W/C is positioned as close to the bed as possible.	Patient & therapist safety	Side of W/C is next to electric bed with no significant gap.
4	W/C brakes are locked and W/C stability is checked prior to beginning transfer.	Patient & therapist safety	Locking of brakes is observed on video, W/C remains in place when pushed/pulled.
5	Leg rests and armrests are removed or swung out of the way.	Patient & therapist safety	Armrest and legrest between simulator and W/C seat are removed.
6	Clear directions regarding patient's role in transfer are given.	Patient & therapist safety	Participant explained to patient that he/she would be assisted to sit on edge of bed and then assisted into a wheelchair in preparation for activity.
7	Patient is moved supine to sit safely.	Patient & therapist safety	Done with elevation of the head of the bed, or safe manual handling techniques. Participant hand placement could not be around the neck.
8	Bed height is adjusted to allow the patient's feet to touch the floor.	Patient & therapist safety	Both feet must touch the floor and the entire foot, including heel must touch the floor.
9	Upright posture of the patient is supported by using proper hand placement that prevents a loss of balance on the edge of the bed.	Patient & therapist safety	Hand placement near scapula and below cervical spine. Hand placement could not be around the neck. Patient could not evidence a loss of sitting balance.

Table 4.2 (continued).

	Procedure	Goal	Evidence
10	Patient is scooted to edge of bed with buttocks remaining on mattress.	Patient & therapist safety	Hips moved contralaterally in a controlled manner. Patient's arms must remain at rest in a normal position and could not get caught on the bed/sheets. Patient must stay on edge of bed and could not slide off edge of mattress.
11	Movement from bed to W/C is smooth and controlled, with no jarring or sudden movements.	Patient & therapist safety	Movements must be coordinated and controlled. Transfer could not be paused midway.
12	Proper body mechanics are used during transfer (back straight, knees bent, head erect).	Patient & therapist safety	Proper body mechanics observed on video (back straight, knees bent, head erect). The patient must have weight shifted and could not be lifted or supported in a standing position.
13	Legrests and armrests are replaced to original position.	Patient & therapist safety	Armrests at side of wheelchair. Legrests observed locked with footplate fully down and patient's feet on them; armrest secure in wheelchair frame.
14	Vital signs are recorded at end of session.	Monitoring of medical stability	Blood pressure, heart rate, respiratory rate, and oxygen saturation are completely and accurately filled in on student's lab sheet.

Note. W/C = wheelchair.

4.2.6 Data Analysis

All data were entered into Windows SPSS Version 19.0, with identification numbers instead of participants' names. The criterion for significance (alpha) was set at 0.05. Descriptive statistics and inferential statistics were computed. Descriptive statistics were used to determine demographic variables of age, gender, type of program and year of academic progress.

Aim 1 compared the levels of knowledge, skills, and safety self-efficacy by teaching method. Three separate one way analyses of variance (ANOVA) were conducted for the Time 3 self-efficacy measure with teaching method as the between subjects variable.

Aim 2 compared the levels of knowledge, skills, and safety self-efficacy by time and teaching method. Three separate time by teaching method analyses using ANOVA were conducted.

Aim 3 predicted skill competency (assessed at T3) from levels of knowledge, skills, and safety self-efficacy at T1 and T2. This was done by completing a linear regression analyses, with T1 and T2 scores used as covariates. A linear regression examined the relationship between knowledge self-efficacy, skills self-efficacy, and safety self-efficacy at Time 1 and and skill competency at Phase III. A linear regression was also used to examine the relationship between knowledge self-efficacy, skills self-efficacy, and safety self-efficacy at Time 2 and skill competency at Phase III. Scores on the performance assessments for the Urinary, Chronic Medical, IV, and Respiratory scenarios used during Phase III determined skill competency. The regression analyses were completed for each scenario separately.

Aim 4 examined the association between levels of knowledge, skills, and safety self-efficacy at T2 and T3 with levels of knowledge, skill and safety self-efficacy at Fieldwork A and B. Self-efficacy data were collected from second year MOT students completing clinical fieldwork assignments. Pearson correlations were performed and the results were used to inform further analyses, which included comparing the three self-efficacy scales at each time point, and across time.

4.3 RESULTS

4.3.1 Descriptive Measures

The sample (N = 108) was comprised primarily of female students (86%). Participants ranged from 21 to 47 years of age, with a mean average age of 25 (SD = 5) years. Most students were in the MOT program (86%), and of the MOT students, there was equal division between first and second year students (see Table 4.3).

Table 4.3 Demographic Information of the Participants

		Program and Year					
		MOT Year 1 (*n* = 47)		MOT Year 2 (*n* = 46)		MS (*n* = 15)	
		Mean (*SD*)	Count	Mean (*SD*)	Count	Mean (*SD*)	Count
Age		25 (5)		25 (5)		23 (1)	
Gender	Male		5		7		3
	Female		42		39		12

4.3.2 Outcome Measures

4.3.2.1 Self-efficacy by Teaching Method

Self-efficacy ratings at Time 3, after the second WISER experience, varied along the full spectrum of very uncertain (a score of 1) to very certain (a score of 10) for teaching methods A and C (see Table 4.4). In contrast, teaching method B group had higher minimum scores (6 for knowledge self-efficacy and 5 for skills self-efficacy), which began at close to the midpoint of the scale for all self-efficacy constructs.

Table 4.4 Self-efficacy Ratings at Time 3

	n	*M*	*SD*	*SE*	Minimum	Maximum
Knowledge						
Method A	34	7.21	2.21	.38	1	10
Method B	37	8.14	0.98	.16	6	10
Method C	35	7.46	1.69	.29	1	10
Total	106	7.61	1.72	.17	1	10
Skills						
Method A	34	6.62	2.36	.41	1	10
Method B	37	7.84	1.24	.20	5	10
Method C	35	7.20	1.51	.26	1	9
Total	106	7.24	1.81	.17	1	10
Safety						
Method A	34	6.32	2.40	.41	1	10
Method B	37	7.22	1.36	.22	4	10
Method C	35	6.80	1.73	.29	1	9
Total	106	6.79	1.88	.18	1	10

Note. M = mean; *SD* = standard deviation; *SE* = standard error of the mean.
Scale = 1 (low) to 10 (high).

A one way ANOVA indicated that the variances of the three groups were significantly different according to Levene’s test. Because this assumption of homogeneity of the groups was broken, the Welch’s test completed this analysis. Teaching method was the independent variable, and knowledge, skill and safety self-efficacy assessment were the dependent variables. There was a significant overall difference between groups in knowledge self-efficacy ratings F(2, 103) = 3.90, p = .026, and skills self-efficacy ratings F(2, 103) = 4.36, p = .017. Results from this analysis appear in Table 4.5.

Table 4.5 ANOVA Self-Efficacy by Teaching Method

		SS	*df*	Mean Square	*F*	Sig.
Knowledge self-efficacy	Between Groups	16.57	2	8.29	3.90	.026*
	Within Groups	292.57	103	2.84		
	Total	309.14	105			
Skills self-efficacy	Between Groups	26.45	2	13.22	4.36	.017*
	Within Groups	316.66	103	3.07		
	Total	343.10	105			
Safety self-efficacy	Between Groups	14.12	2	7.06	1.99	.146
	Within Groups	357.31	103	3.47		
	Total	371.43	105			

Note. *SS* = sum of squares*; df* = degrees of freedom; *F* = *F* distribution*;* Sig. = significance.
* *p* < .05.

Because there was no specific hypothesis about the effect that teaching method might have on ratings of self-efficacy, post hoc tests compared all teaching method groups with each other to determine the effect that teaching method might have on ratings of self-efficacy. Due to the unequal variances of the groups, Dunnett’s test, which has rigorous control for Type I error, was used.

While there were no significant pairwise differences in knowledge, there was one significant pairwise difference for skills. Results were significantly different in skills self-efficacy between teaching method A and teaching method B (p = .029). Participants in method B (two active participation, one active observation) rated Skills self-efficacy significantly higher than participants in method A (one active participation, two active observations). There were no other significant differences between teaching method groups for self-efficacy ratings.

4.3.2.2 Self-efficacy over Time

We hypothesized that a significant decrease in levels of knowledge self-efficacy, skills self-efficacy and safety self-efficacy would occur from Time 1 to Time 2 (from the classroom to the initial WISER experience; see Table 4.6).

Table 4.6 Descriptives for Self-Efficacy at Time 1 and Time 2

		M	*SD*	*n*
	Knowledge Self-efficacy			
Time 1	Method A	8.54	1.38	35
	Method B	8.68	1.28	38
	Method C	8.80	1.41	35
	Total	8.68	1.35	108
Time 2	Method A	6.71	2.42	35
	Method B	7.13	1.70	38
	Method C	6.57	2.20	35
	Total	6.81	2.11	108
	Skills Self-efficacy			
Time 1	Method A	7.74	1.87	35
	Method B	8.11	1.54	38
	Method C	8.20	1.55	35
	Total	8.02	1.65	108
Time 2	Method A	6.54	2.36	35
	Method B	6.79	1.61	38
	Method C	6.31	2.23	35
	Total	6.56	2.07	108
	Safety Self-efficacy			
Time 1	Method A	7.89	1.89	35
	Method B	7.97	1.31	38
	Method C	8.23	1.14	35
	Total	8.03	1.47	108
Time 2	Method A	6.34	2.53	35
	Method B	6.34	1.88	38
	Method C	6.14	2.33	35
	Total	6.28	2.23	108

A repeated measure ANOVA examined the main effect of time on self-efficacy, and the interaction effect of time and teaching method on self-efficacy. The analysis indicated that there was a significant difference in knowledge self-efficacy (*F*(1, 2) = 109.21, p < .001), skills self-efficacy (*F*(1, 2) = 62.60, p < .001), and safety self-efficacy (*F*(1, 2) = 64.91, p < .001) between Time 1 (classroom) and Time 2 (the first WISER experience). None of the interaction effects were significant. Participants rated self-efficacy in all three domains (knowledge, skills, and safety) significantly *lower* at Time 2 compared to Time 1. This supported our hypothesis that self-efficacy ratings would significantly decrease from Time 1 to Time 2. The non-significant interaction effect demonstrated that the amount of change did not differ across teaching methods. Partial eta squared indicated that the effect for time by group was small for all the self-efficacy constructs (see Table 4.7)

Table 4.7 Self-efficacy Changes from Time 1 to Time 2

Source	*SS*	*df*	MS	*F*	Sig.	Partial Eta Squared
Knowledge self-efficacy						
Teaching Method	3.21	2	1.61	0.35	.705	.01
Error(Teaching Method)	481.28	105	4.58			
Time	188.53	1	188.53	109.21	.000**	.51
Time*Teaching Method	4.19	2	2.10	1.21	.301	.02
Error(Time)	181.27	105	1.73			
Skills self-efficacy						
Teaching Method	3.47	2	1.74	0.33	.718	.01
Error(Teaching Method)	547.73	105	5.22			
Time	116.07	1	116.06	62.60	.000**	.37
Time*Teaching Method	4.75	2	2.38	1.28	.282	.02
Error(Time)	194.68	105	1.85			
Safety self-efficacy						
Teaching Method	0.182	2	0.09	0.02	.981	.039
Error(Teaching Method)	489.28	105	4.66			
Time	165.77	1	165.77	64.91	.000**	.38
Time*Teaching Method	2.99	2	1.50	0.59	.559	.01
Error(Time)	268.14	105	2.55			

Note. SS = Sum of squares; *df* = degrees of freedom; *F* = *F* distribution; Sig. = significance.
** *p* < .001.

The next analysis addressed changes in self-efficacy ratings from Time 2 to Time 3 (Table 4.8). This analysis revealed that there was a significant difference in knowledge self-efficacy (*F*(1, 2) = 20.134, *p* < .001), skills self-efficacy (*F*(1, 2) = 13.923, *p* < .001), and safety self-efficacy (*F*(1, 2) = 7.501, *p* < .05) between Time 2 and Time 3 (the first WISER experience and the second WISER experience). Participants rated self-efficacy in all three domains significantly *higher* at Time 3 in comparison to Time 2.

Table 4.8 Self-efficacy Changes from Time 2-Time 3

Source	*SS*	*df*	Mean Square	*F*	Sig.	Partial Eta Squared
Knowledge self-efficacy						
Teaching Method	19.76	2	9.88	1.72	.184	.03
Error(Teaching Method)	591.48	103	5.74			
Time	28.07	1	28.07	20.13	.000**	.16
Time*Teaching Method	3.70	2	1.85	1.33	.270	.03
Error(Time)	143.60	103	1.39			
Skills self-efficacy						
Teaching Method	19.33	2	19.66	1.66	.196	.03
Error(Teaching Method)	600.78	103	5.83			
Time	22.13	1	22.13	13.92	.000**	.12
Time*Teaching Method	11.17	2	5.59	3.51	.033*	.06
Error(Time)	163.72	103	1.59			
Safety self-efficacy						
Teaching Method	7.22	2	3.61	0.52	.598	.01
Error(Teaching Method)	718.71	103	6.98			
Time	11.64	1	11.63	7.50	.007*	.07
Time*Teaching Method	8.41	2	4.21	2.71	.071	.05
Error(Time)	159.82	103	1.55			

Note. *SS* = Sum of squares; *df* = degrees of freedom; *F* = *F* distribution; Sig. = significance.
**p* < .05; ** *p* < .001.

This supported our hypothesis that self-efficacy ratings would significantly increase from Time 2 to Time 3. There was a significant difference in amount of change for skills self-efficacy ratings by teaching method ($F(1, 2) = 3.51$, $p < .033$). Teaching methods B and C participants had a greater increase in skills self-efficacy in comparison to teaching method A participants. Contrasts revealed no significant difference in knowledge self-efficacy ratings and safety self-efficacy rating among teaching methods. Partial eta squared indicated that the effect for time by group was small for all of the self-efficacy constructs.

4.3.2.3 Self-efficacy as a Predictor of Performance

Levels of knowledge self-efficacy, skills self-efficacy and safety self-efficacy at Time 1 and Time 2 were examined to determine if they were predictive of skill competency, which was assessed during Phase III. Results were not significant (Table 4.9). Although all correlations were weak to negligible, the Urinary scenario had the highest correlation between self-efficacy ratings and skill competency ($R = .24$, $R2 = .06$), followed by the Chronic Medical scenario ($R = .24$, $R2 = .05$), IV scenario ($R = .19$, $R2 = .04$), and Respiratory scenario ($R = .13$, $R2 = .02$). There was no statistical evidence to support that participants' self-efficacy ratings after classroom instruction and laboratory practicum were predictive of skill competency demonstrated later in a simulated environment. Participant knowledge self-efficacy, skills self-efficacy and safety self-efficacy ratings at Time 1 did not predict skill competency scores at Phase III.

Table 4.9 Time 1 Self-efficacy as a Predicator of Performance

	Unstandardized Coefficients		Standardized Coefficients		
	β	*SE*	β	*t*	Sig.
Urinary scenario skill competency percentage (n = 53)					
(Constant)	90.50	15.30		5.92	.000
Knowledge Self-efficacy	-3.91	2.66	-.35	-1.47	.147
Skills Self-efficacy	2.03	2.17	.27	.94	.353
Safety Self-Efficacy	1.26	1.91	.14	.66	.513
Chronic Medical scenario skill competency percentage (n = 52)					
(Constant)	84.20	11.14		7.56	.000
Knowledge Self-efficacy	-2.52	2.05	-.33	-1.23	.225
Skills Self-efficacy	2.09	1.72	.38	1.22	.230
Safety Self-Efficacy	0.53	1.65	.08	0.32	.747
IV scenario skill competency percentage (n = 49)					
(Constant)	91.88	7.30		12.58	.000
Knowledge Self-efficacy	-.71	1.10	-.14	-0.65	.522
Skills Self-efficacy	-.83	1.32	-.18	-0.63	.535
Safety Self-Efficacy	1.17	1.27	.23	0.92	.361
Respiratory scenario skill competency percentage (n = 54)					
(Constant)	81.44	12.29		6.63	.000
Knowledge Self-efficacy	-0.96	1.93	-.099	-0.50	.620
Skills Self-efficacy	1.30	1.69	.193	0.77	.447
Safety Self-Efficacy	-0.20	1.73	-.026	-0.11	.910

Note. β = beta; *SE* = standard error; *t* = Student's t-test; Sig = significance.

We also examined the relationship between knowledge self-efficacy, skills self-efficacy and safety self-efficacy at Time 2 and skill competency at Phase III (Table 4.10). Results were significant only for the Urinary scenario And again, the Urinary scenario had the highest correlation between self-efficacy ratings and skill competency (R = .32, R2 = .10), followed by the Chronic Medical scenario (R = .29, R2 = .09), IV scenario (R = .23, R2 = .05), and Respiratory scenario (R = .13, R2 = .02). Although it was hypothesized that knowledge self-efficacy, skills self-efficacy, and safety self-efficacy ratings at both Time 1 and Time 2 would predict skill competency, this was not substantiated. Only the Urinary scenario, when examined in association with knowledge self-efficacy ratings at Time 2 could be considered predictive of skill competency.

Table 4.10 Time 2 Self-efficacy as a Predictor of Performance

	Unstandardized Coefficients		Standardized Coefficients		
	β	*SE*	β	*t*	Sig.
Urinary scenario skill competency percentage (n = 53)					
(Constant)	82.58	5.27		15.66	.000
Knowledge Self-efficacy	-3.41	1.63	-.62	-2.10	.041*
Skills Self-efficacy	3.54	1.83	.71	1.93	.059
Safety Self-Efficacy	-.03	1.34	-.01	-.02	.985
Chronic Medical scenario skill competency percentage (n = 52)					
(Constant)	78.61	4.52		17.38	.000
Knowledge Self-efficacy	-0.42	1.29	-.09	- 0.32	.750
Skills Self-efficacy	3.02	1.63	.71	1.85	.071
Safety Self-Efficacy	-1.94	1.29	-.48	- 1.50	.141
IV scenario skill competency percentage (n = 49)					
(Constant)	93.32	3.93		23.73	.000
Knowledge Self-efficacy	-1.04	0.80	-.29	-1.31	.198
Skills Self-efficacy	0.73	1.48	.20	0.50	.622
Safety Self-Efficacy	-0.37	1.14	-.11	-0.32	.749
Respiratory scenario skill competency percentage (n = 54)					
(Constant)	79.20	5.20		15.24	.000
Knowledge Self-efficacy	-0.19	1.06	-.040	-0.18	.861
Skills Self-efficacy	1.40	1.71	.268	0.82	.415
Safety Self-Efficacy	-0.82	1.25	-.177	-0.66	.514

Note. β = beta; *SE* = standard error; *t* = Student’s t-test; Sig = significance.
* $p < .05$.

4.3.2.4 Self-efficacy and Clinical Fieldwork

We examined the association between levels of knowledge self-efficacy, skills self-efficacy and safety self-efficacy at Time 2 (after the initial WISER experience) and Time 3 (after the second and final WISER experience) with levels of knowledge self-efficacy, skills self-efficacy and safety self-efficacy after Fieldwork A and Fieldwork B.

The average self-efficacy ratings for Fieldwork A in all dimensions (knowledge, skills and safety) ranged from 7.57 to 7.88 on a scale from 1 to 10. For Fieldwork B, the mean average ratings increased for all dimensions to 7.69 to 8.34, with the highest mean average in safety self-efficacy (Table 4.11).

Table 4.11 Descriptive Statistics: Self-efficacy Ratings Fieldwork A and Fieldwork B

	n	Minimum	Maximum	*M*	*SD*
Fieldwork A					
Knowledge self-efficacy	44	4	10	7.70	1.21
Skills self-efficacy	44	2	10	7.57	1.56
Safety self-efficacy	41	5	10	7.88	1.45
Fieldwork B					
Knowledge self-efficacy	42	3	10	7.95	1.64
Skills self-efficacy	42	3	10	7.69	1.72
Safety self-efficacy	41	5	10	8.34	1.32
Valid N (listwise)	39				

Note. *M* = mean; *SD* = standard deviation

Expecting that only positive relationships would be found, one-tailed Pearson correlations were used (Table 4.12). Results revealed several trends. The first was a strong correlation between self-efficacy ratings after the final WISER simulation experience and the self-efficacy ratings during the Fieldwork A. There was also strong correlation between self-efficacy ratings between Fieldwork A and B.

Self-efficacy ratings at Time 2 were not related to any self-efficacy ratings for Fieldwork A. Knowledge self-efficacy, skills self-efficacy and safety self-efficacy ratings at Time 2 were all significantly correlated ($p < .05$) to knowledge self-efficacy and skills self-efficacy for Fieldwork B. However, Time 2 safety self-efficacy was not correlated to any Fieldwork B self-efficacy ratings.

Knowledge self-efficacy at T3 was significantly related ($p < .001$) to both Fieldwork A and Fieldwork B knowledge self-efficacy. Skills self-efficacy at T3 was also significantly related ($p < .001$) to both Fieldwork A and B knowledge self-efficacy. Time 3 skills self-efficacy was significantly correlated with skills self-efficacy during Fieldwork A and B. Skills self-efficacy at Time 3 demonstrated a stronger correlation during Fieldwork B ($r = .40$, $p < .001$) than Fieldwork A ($r = .32$, $p < .05$), although both were significant. Safety self-efficacy at Time 3 demonstrated a stronger relationship at Fieldwork B ($r = .36$, $p < .001$) than Fieldwork A ($r = .33$, $p < .05$). Safety self-efficacy at Time 3 was significantly related to knowledge self-efficacy at Fieldwork A and B ($p < .05$).

Table 4.12 Relationships Among Time 2, Time 3 and Fieldwork Self-Efficacy Fieldwork Ratings

		Fieldwork A			Fieldwork B		
		Knowledge	Skills	Safety	Knowledge	Skills	Safety
		Time 2 Self-Efficacy					
Knowledge	Pearson Correlation	.22	.16	.01	.35*	.23*	.12
	N	44	44	41	42	42	41
Skills	Pearson Correlation	.24	.19	.15	.31*	.34*	.10
	N	44	44	41	42	42	41
Safety	Pearson Correlation	.19	.13	.13	.30*	.29*	.09
	N	44	44	41	42	42	41
		Time 3 Self-Efficacy					
Knowledge	Pearson Correlation	.35**	.37**	-.07	.38**	.43**	.15
	N	44	44	41	42	42	41
Skills	Pearson Correlation	.36**	.32*	.09	.39**	.40**	.03
	N	44	44	41	42	42	41
Safety	Pearson Correlation	.32*	.33*	.14	.30*	.36**	.04
	N	44	44	41	42	42	41

*p < .05 (1-tailed); **p < .001 (1-tailed).

Another aspect explored was the relationship among the three self-efficacy constructs themselves. Pearson correlations indicated significant relationships between skills self-efficacy and knowledge self-efficacy (Table 4.13).

Table 4.13 Relationships Among Self-Efficacy Concepts

	Time 2			Time 3			FWA			FWB		
	K	S	Sa	K	S	Sa	K	S	Sa	K	S	Sa
						Time 2						
2 K												
2 S	.82**											
2 Sa	.73**	.88**										
						Time 3						
3 K	.62**	.55**	.54**									
3 S	.54**	.57**	.57**	.82**								
3 Sa	.57**	.61**	.63**	.75**	.83**							
						FWA						
K	.22	.24	.19	.35*	.36*	.32*						
S	.16	.19	.13	.37*	.32*	.33*	.78**					
Sa	.01	.15	.13	-.07	.09	.14	.54**	.47**				
						FWB						
K	.35*	.31*	.30	.38*	.39*	.30	.44**	.38*	.13			
S	.30	.34*	.29	.43**	.40**	.36*	.47**	.42**	.26	.91**		
Sa	.12	.10	.09	.15	.03	.04	.45**	.44**	.48**	.59**	.65**	

Note. FWA = Fieldwork A. FWB = Fieldwork B. K = Knowledge self-efficacy. S = Skills self-efficacy. Sa = Safety self-efficacy.
Time 2 and Time 3 correlations *n* = 106. FWA Knowledge self-efficacy and Skills self-efficacy *n* = 44. FWB Knowledge self-efficacy and Skills self-efficacy *n* = 42. FWA and FWB Safety self-efficacy *n* = 41.
**p* < .05 (two-tailed). ***p* < .001 (two-tailed).

This relationship between the constructs continued over time, from Time 2 ($r = .82$, $p < .001$), to Time 3 ($r = .82$, $p < .001$), to Fieldwork A ($r = .78$, $p < .001$) and to Fieldwork B ($r =$

.91, $p < .001$). In fact, the strongest self-efficacy correlation was between knowledge self-efficacy and skills self-efficacy at Fieldwork B. Safety self-efficacy during non-clinical phases of this project (Time 2 and Time 3) had no significant correlation with safety self-efficacy during Fieldwork A and B. Safety self-efficacy correlated with knowledge and skills self-efficacy for each individual phase, however.

4.4 DISCUSSION

There were four hypotheses for this project. Each hypothesis centered around self-efficacy. Using cognitive learning theory as a framework, knowledge self-efficacy, skills self-efficacy and safety self-efficacy were examined in relation to performance of transfers. Discussion of these results is organized by hypotheses.

4.4.1 Self-efficacy and Teaching Method

Cognitive learning theory proposes that vicarious experiences (active observations) are effective for learning but not as strong as enactive experiences (active participations). However, the self-efficacy of our students did not support this proposition. The group with three active participations (transfers) did not differ significantly from the groups with one active participation/two observations or one observation/two active participations. Following the second WISER experience, a combination of observation and participation was just as influential as participation alone in determining self-efficacy ratings. This may be one reason that the combination group with a larger dosage of participation than observation had higher skills self-efficacy ratings than the group with the least amount of active participation. Another explanation for this result may be that this group completed the same number of transfers during each WISER experience. This equivalence may have reinforced their self-efficacy beliefs, as both experiences required the same amount of effort (completion of two transfer scenarios) and potentially generated the same level of fatigue. Participants in the teaching group with one participation and two observations may have had a higher probability of failure or negative experiences inherent in the repeated consecutive challenge of the scenarios, because in their first exposure they had only one opportunity to perform a transfer. Participants may have been able to complete a single transfer successfully during the first WISER experience, however, when faced with a second challenge during the next phase at the WISER the likelihood of success may have decreased because they now had to complete two transfers during the same WISER visit.

We hypothesized that there would be no difference in the self-efficacy ratings of students assigned to the three teaching methods following their WISER competency test. An analysis of teaching methods and self-efficacy indicated that students exposed to a combination of two active participations and one active observation (teaching method B) rated their skills self-efficacy significantly higher than participants exposed to one active participation and two active observations (teaching method A). This however, was the only significant difference noted. Safety self-efficacy and knowledge self-efficacy ratings did not significantly differ by teaching method. Additionally, participants randomized to three active participation experiences (teaching method C) did not significantly differ in skill self-efficacy from the other two teaching groups with combined active observation and active participation experiences.

4.4.2 Self-efficacy over Time

Self-efficacy was also examined as it changed over time. As hypothesized, self-efficacy in all constructs (knowledge, skills, and safety) declined significantly from the classroom to WISER. There may be several reasons for this decline. Participants may have been completing their first truly dependent transfer. In the classroom, participants had transferred colleagues who could have unknowingly assisted with the dependent transfer. Peers may assist with what should be a dependent transfer for many reasons. They may be concerned for self-injury if the transfer is not successful and they are dropped or lowered to the floor. Peers may be concerned for the academic standing of their classmate and assist to assure a successful transfer. Another possibility is that some individuals are unable to maintain the fully relaxed posture that is required for their peer to assume the full-weight bearing needed for a dependent transfer.

Another reason for this decline in self-efficacy may have been the change in environment. The participants experienced drastic environmental changes between the classroom and WISER as they moved from transferring peers in a familiar environment to using the high-technology medical simulators in a realistic acute care environment. Prior to this time, participants were in a familiar, quiet classroom. Distractions were purposely kept to a minimum to promote concentration. Also, successful completion of the transfer scenario did not involve management of an unanticipated critical event. When participants completed their transfers at WISER, the environmental factors were vastly different. The transfers were performed with inanimate simulators so a fully dependent transfer was assured. Participants were in an unfamiliar environment with multiple distractions, both visual and auditory (monitors, colleague observers). Successful completion of the transfer scenario required management of equipment (hospital bed, various lines, drains, tubes) with which they had little hand-on experience.

Moreover, participants had to manage the procedural mechanisms of the transfer and combine these skills with clinical reasoning to respond appropriately to the unexpected critical event.

At Time 3, when the participants returned to WISER to complete a new set of transfer scenarios, different but parallel to those they had experienced at WISER at Time 2, there was a significant increase in self-efficacy for all constructs (knowledge, skills, and safety) from Time 2 to Time 3. Although the critical clinical events and medical diagnosis of the scenarios were different, other aspects of the procedures and environment were kept the same, such as the transfer task, the medical theatre room set-up, the basic equipment used (hospital beds and monitors) and the amount of time the students had to complete the task. Because neither the task nor the environment was new to the participants, the level of self-efficacy appropriately reflected the gains associated with previous exposure to the learning tasks (Lorenz, Gregory & Davis, 2000).

4.4.3 Self-efficacy as a Predictor of Performance

Our third aim was to examine the predictive value of self-efficacy. Results indicated that participant knowledge self-efficacy, skills self-efficacy, and safety self-efficacy ratings taken after the classroom and first WISER experience were not strong predictors of the second WISER skill competency scores. Only one aspect of self-efficacy rated after the first WISER experience, namely knowledge self-efficacy was predictive of performance, and prediction was limited to one of the four scenarios used--the Urinary scenario.

Previous research in the healthcare field has found that higher self-efficacy is not always related to better motor task performance (Colthart et al., 2008; Ellis et al., 2010). Successful patient transfers require a complex set of motor skills as well as cognitive processes. Therefore, it is not surprising that self-efficacy in our study had such a limited predictive ability. In contrast, some researchers have supported self-efficacy as a predictor of performance and practice behaviors (Docherty et al., 2005; Lorenz et al., 2000; Pike & O'Donnell, 2010). However, research focusing on the positive predictive ability of self-efficacy for performance has focused mostly on performance of cognitive tasks. Bandura (1986, 1997) states that self-efficacy is a belief about abilities and not always an accurate assessment of skills.

4.4.4 Self-efficacy Construct Association

Finally, we examined the association between levels of self-efficacy during the classroom and simulation learning points with levels of self-efficacy during clinical fieldwork. Self-efficacy is a dynamic assessment based in part on the ability to process information and respond to a task demand (Bandura, 1993). Consistent with the theory of self-efficacy as a self-assessment of performance abilities, as participants had increased exposure to transfers and the acute care clinical environment became more familiar, self-efficacy ratings were adjusted upward. Throughout the students' educational program there was a trend for self-efficacy ratings from each phase of the study to be associated with subsequent self-efficacy ratings. For example, self-efficacy ratings at Time 2 correlated with all self-efficacy ratings at Time 3 but not many self-efficacy ratings at the first fulltime fieldwork experience (Fieldwork A). Over time the correlations became weaker, and thus by the end of the project at the time of the second fulltime fieldwork experience (Fieldwork B), self-efficacy ratings from Time 2 only correlated with three self-efficacy ratings.

Another pattern noted was the strong association of knowledge self-efficacy and skills self-efficacy. Throughout the study these constructs were consistently correlated, within each phase and across time. The strongest correlation occurred during the final phase of the project (the second fieldwork experience), between knowledge self-efficacy and skills self-efficacy. This may be due to an inherent link between knowledge and skills. For successful completion of a performance task, such as patient transfer, both knowledge and skills are needed. While knowledge could be interpreted as the cognitive portion of the task and skills the motor portion of the task, both components must be present for the transfer to be completed correctly. Thus, at the end of their academic program, the relationship between students' knowledge and skills self-efficacy was the strongest.

Another trend noted concerns safety self-efficacy ratings. Safety self-efficacy had the lowest number of significant correlations among the three self-efficacy constructs. While safety self-efficacy was correlated with knowledge self-efficacy and skills self-efficacy, these correlations occurred less frequently during the second WISER experience and the first fieldwork, and more frequently at the beginning and end of the project (first WISER experience and second fieldwork). Safety self-efficacy, therefore, was most strongly related to changes in setting. When the environment changed the students were exposed to a novel situation in which the outcome was dependent upon their actions. This likely heightened their awareness of the importance of safety practices to prevent injury and harm. During the first WISER experience and the first clinical fieldwork experience students were made acutely aware of the consequences of their actions. The actions of the simulators responses of actual patients were related directly to student interventions and provided immediate observable feedback. Students were more aware of their safety self-efficacy as they mastered transfers in WISER and again as they refined their skills during their second fieldwork, while preparing for entry-level practice.

Finally, it should be noted that overall there were multiple significant correlations among time points and self-efficacy constructs. This is important because self-efficacy has historically been assessed as a general measure by asking respondents their beliefs about a task without providing details about the task specifics. Few rating scales provide specific inclusion or exclusion criteria. Self-efficacy surveys do not usually ask respondents how confident they feel to perform a task in a particular environment, on a specific day, or with a specific set of circumstances detailed in the question. For example, surveys ask how confident respondents are about a task without delineating the specific setting or method of completion. In this study we examined constructs of the same self-efficacy type over time as the setting and methods varied, which reflected both the setting and the method of completion. This additional dimension of self-efficacy reflected the evolution of these beliefs.

4.5 STUDY LIMITATIONS

Participants were entry-level occupational therapy students and comprised a convenience sample. This limits the generalizability of the results. Participants were aware that they were participating in a research study and this awareness may have also biased the results. Because participants were tested on the same days, there is the potential that the students participating earlier in the day communicated information about the unexpected critical clinical events to students participating later in the day. This may have promoted sharing of ideas and strategies to manage the critical clinical event. Also, a few participants did not approach the simulations with a considerate focus and shared their beliefs that the simulation experience was frivolous. They were overtly casual and cavalier in their handling of the simulator and management of the critical clinical event.

Although raters were masked to the purpose of the study and to the group assignment of the participants, the videotape review may have allowed for facial recognition. The same raters were used for both WISER experiences and it is possible that the raters remembered how many transfers a participant completed in the first WISER experience, thus biasing the second WISER performance assessment scores.

Fieldwork A and B self-efficacy rating may not have been based on equitable transfer exposures. Some students documented that they had not completed dependent adult bed to wheelchair transfers during their clinical fieldwork experiences. This exposure could have occurred during either or both fieldwork experiences.

4.6 SUGGESTIONS FOR FUTURE RESEARCH

Clinical fieldwork experiences are the transition between classroom learning and entry-level practice. The use of simulation provided a unique opportunity to measure students' self-efficacy, in response to acute care scenarios designed to promote safe transfer skills and critical reasoning for medically fragile and clinical complex patients. Because the consequences of the learner's action were immediately observable and provide valuable information to the learner and the instructor, development of additional scenarios that focus on safety, clinical reasoning and other common medical conditions should be explored.

Additional study to determine if the fieldwork self-efficacy ratings are significantly different for those that experience simulation training than those who do not would provide information about the long-term utility of simulation within the curriculum. Simulation may be an additional expense for academic programs and takes time away from lecture and traditional laboratory experiences. It is important to determine the utility of simulation in comparison to other traditional methods for transfer training.

Both observation and participation are used as teaching methods in the classroom with occupational therapy students and in the clinic with patients. In the classroom, instructors use a combination of videotape review, peer demonstration and laboratory experiences with varying levels of active participation. In the clinic, occupational therapists are often responsible for patient education to promote task completion. Client teaching is usually done with a combination of both therapist demonstration and client performance. Additional study to determine the correct 'dosage' of these interventions for transfer training in both settings is warranted.

Another important area for further study is the critical clinical event criteria and their relationship to self-efficacy. Although some participants were able to complete the transfer successfully, they were not able to manage the critical clinical event. Further analysis of the interaction between self-efficacy and the management of the embedded critical clinical events is needed.

This study did not indicate that self-efficacy consistently predicted performance. Despite multiple studies, no consistent results have been identified that conclusively link self-efficacy as a predictor of performance (Bandura & Locke, 2003; Barnsley et al., 2004; Colquitt et al., 2000; Davis et al., 2006; Leopold et al., 2005; Salas & Canon-Bowers, 2001; Stajkovis & Luthans, 1998). Because patient transfers require both a motor component and a cognitive component, further study is needed to determine if self-efficacy is predictive of either of these individual components. Further analysis of performance as defined by each participant's scores during

Phase III (the second WISER experience) should be undertaken. An analysis of this type would align prior scenario performance scores with future scenario performance scores and may provide a more rigorous and valid measure of transfer ability.

5.0 CONCLUSION

5.1 OBJECTIVES AND AIMS

Self-efficacy was examined to determine its effects upon learning and performance of transfers of medically fragile and complex patients in an acute care environment. This study was part of a larger study designed to assess the effectiveness of simulation to teach occupational therapy students patient transfer skills. The general objectives of this study were:

1. To create realistic scenarios for a patient transfer from the bed into a wheelchair. These scenarios had to include a commonly occurring critical event, be parallel in structure and allow for objective performance assessment, and

2. To examine self-efficacy as it related to teaching method and time.

Four aims were proposed to closely and methodically examine the relationships between self-efficacy and learning. All aims related to knowledge self-efficacy, skills self-efficacy and safety self-efficacy. Aim 1 compared the levels of knowledge self-efficacy, skills self-efficacy and safety self-efficacy by teaching method to determine if active participation (performance of a transfer) and active observation (observation of peer performance of a transfer) influenced self-efficacy. Aim 2 compared the levels of knowledge self-efficacy, skills self-efficacy and safety self-efficacy by time to determine how self-efficacy was affected by transitioning from the classroom laboratory with peer experience to a high-technology center replicating a hospital with simulator experience. Aim 3 sought to predict skill competency from levels of knowledge self-efficacy, skills self-efficacy and safety self-efficacy at various time points. Aim 4 examined the associations among levels of knowledge self-efficacy, skills self-efficacy and safety self-efficacy at various time points.

5.2 SUMMARY OF FINDINGS

This study examined self-efficacy and its influence on skill competency when various exposures to simulation were used as teaching methods. Participants were students enrolled in graduate occupational therapy programs at the University of Pittsburgh.

There were multiple phases to this study. Participants first learned about patient handling and transfer techniques with traditional classroom education. This was accompanied by laboratory training and practice with peers. Participants were then randomly assigned to one of three groups wherein they were exposed to differing levels of participation in, and observation of, patient handling and transfers. During this time, participants completed patient handling and transfers in a simulation center which mimics an acute care environment. Transfers were completed with a high tech simulator. In addition, each transfer was embedded in a scenario that contained a common critical event. This critical event involved spontaneous problem solving and clinical reasoning.

After each phase, self-efficacy ratings for knowledge, skills and safety were obtained. After each active participation experience the students' performance during the scenario was scored on a performance assessment. The performance assessment scores determined the skill competency of the participant. Hypotheses were generated on the relationship between self-efficacy and performance assessments used during the patient handling and transfers in the classroom and at the WISER.

Chapter 2 includes a literature review of the current theories and practices pertaining to patient handling and the use of simulation in medical education. Because this project addressed the use of simulation as a teaching method, learning theories as they related to simulation in clinical education were also included. Cognitive learning theory, which blends self-efficacy and performance, formed the basis for this study. Literature on self-efficacy was examined in depth as it is the major construct measured and explored in this study.

Chapter 3 is Article 1 from the study, and describes scenario development for the final self-efficacy analyses. Scenarios with a high degree of ecological validity were created. The seven scenarios replicate common clinical situations and balance a consistent motor task (transfer from the bed into a wheelchair) with a unique critical clinical event. The critical events all revolved around patient monitoring and equipment management, two of the most important clinical skills needed when caring for a medically fragile population. The scenarios were constructed in a parallel manner with some revolving around equipment management (IV, Urinary, Respiratory, Post-operative scenarios, Pulmonary) and others focused on patient monitoring (Chronic Medical and Cardiac).

The scenarios were found to have a high degree of ecological validity and were ranked between 9.0-9.5 on a scale from 1 to 10 (high validity) by clinical raters with acute care experience. The scenarios were also ranked on safety, proper use of equipment and technology, and complexity. The overall ratings combining all these areas ranged from 7.6 - 8.6 on a 10-point scale. Students also rated the scenarios highly effective for learning. As the students moved through the classroom-based curriculum and on toward their clinical fieldwork experiences, the scenario effectiveness ratings gradually decreased from an initial rating of 8.8 to a rating of 6.9.

Chapter 4, Article 2 from this study, explored self-efficacy and skill competence by examining the relationship between these two variables in multiple ways. First, self-efficacy was examined as it related to the teaching methods used. The study used different ‘dosages’ of active participation and active observation to teach patient handling skills. Opportunities to participate in (active participation) a transfer ranged from one to three, and opportunities to observe (active observation) a transfer ranged from none to two. All participants had a combination of three experiences. No participant had more than three active participation experiences, or more than two active observation experiences. Students randomized to two active participations and one active observations rated skills self-efficacy significantly higher than participants in the teaching method that included one active participations and two active observations. There were no other significant differences between teaching method groups for self-efficacy ratings in knowledge or safety.

Self-efficacy was also assessed at multiple time points. All self-efficacy constructs (knowledge, skills, and safety) declined significantly from the classroom laboratory experience to the initial simulation experience, and this was expected. Students had been in a familiar academic environment, they had used peers as “patients”, and they were assessed only on the mechanical aspects of the transfer. During the simulation experience, they were immersed in an unfamiliar and medical—not academic—environment. The simulators were the “patients”, and the students had to manage a critical and unexpected event. This event required immediate judgment and problem-solving skills and presented immediate and observable consequences. Self-efficacy ratings declined as student’s were faced with these new challenges.

In contrast, self-efficacy ratings increased significantly between the first and second simulation experience. This was true for knowledge self-efficacy, skills self-efficacy and safety self-efficacy. While there was no significant difference in knowledge self-efficacy ratings and safety self-efficacy ratings among teaching methods, skills self-efficacy ratings were sensitive to teaching method. Participants in teaching method B, which had two active participation experiences demonstrated a greater increase in skills self-efficacy compared to the teaching method with the least amount of active participation (method A). This may be because the second simulation experience provided an experience that was similar to their first simulation exposure and thereby increased their confidence. Teaching method C had more initial active participation experiences, so it is likely that these participants had less of a change in self-efficacy as they had a more rigorous exposure earlier in the study. Participants in teaching method A, in contrast to the other groups, had more exposure during their second simulation experience, because they had to complete only one transfer during their first exposure.

We also examined self-efficacy as a variable predictive of performance, based on environments. There was no statistical evidence to support that participants' self-efficacy ratings after the classroom instruction and laboratory practicum environment were predictive of skill competency demonstrated in the WISER simulated environment. Participant knowledge self-efficacy, skills self-efficacy and safety self-efficacy ratings at Time 1 did not predict skill competency scores at WISER Phase III. This is likely due to the significant change in the transfer experience itself, including the environment, the object (previously a human now a simulator) and the unexpected critical clinical event. We then examined the predictive ability of self-efficacy ratings to determine performance if the environment was the same, using the two WISER exposures. Only the Urinary scenario, when examined in association with knowledge self-efficacy ratings after the initial WISER simulation exposure, was predictive of skill competency at the second WISER exposure. No other scenarios at any other time point were predictive of skills competency. Given the limited predictive findings, it appears that the Urinary scenario, with the least amount of complexity among scenarios used to assess competency, was able to most strongly reflect the interaction between self-efficacy and skills competency.

Finally, the relationship among the three self-efficacy constructs was studied. There were multiple correlations of self-efficacy over time, from one time point to the next and between the constructs themselves. The relationship between skills self-efficacy and knowledge self-efficacy extended throughout the students' educational program, even into clinical fieldwork. In fact, the strongest self-efficacy relationship was between knowledge self-efficacy and skills self-efficacy at the second fieldwork, immediately prior to academic graduation and entry-level status as a professional. In contrast, safety self-efficacy was strongly affected by the environment. Each time the environment changed (classroom to WISER, WISER to clinical fieldwork) safety self-efficacy was strongly and negatively influenced.

In summary, these two studies suggest that the influence of self-efficacy on patient handling and transfers varies over time. Over time, students with a combination of observation and participation experiences reported no significant difference in self-efficacy ratings when compared to students with participation experiences only. Self-efficacy had limited application to prediction of skills competency in this study. Participants reported that the use of simulation and the embedded critical events were powerful experiences in learning to manage the care of the medically fragile and clinically complex patient.

5.3 LIMITATIONS OF THIS STUDY

As with any project, this study had limitations. Participants were graduate students and thus comprised a convenience sample limited to the Department of Occupational Therapy. This limits the generalization of the results. Because all participants were assessed on the same days, there is the potential that students participating earlier in the day communicated information about the unexpected critical events to students participating later in the day. Having knowledge of the critical event may have inflated the performance assessment scores, as the student participants could have strategized appropriate responses in advance. Also, the participants were aware that they were involved in a research study which may have introduced bias into their responses.

Although raters were masked to the teaching methods group of the participants, the videotape review allowed for facial recognition. As the same raters reviewed both the initial simulation experience when participants were randomly assigned a teaching method, it is possible that the rater remembered how many transfers a participant completed, thus biasing the performance assessment in some way.

During Fieldwork A and B self-efficacy ratings may not have been based on equitable transfer exposure. Some students documented that they had not completed patient transfers during their fieldwork. This was noted in settings such as pediatrics, or outpatient clinics. This limited exposure could occur either during the first or the second fieldwork experience and may have influenced self-efficacy ratings over time.

Another limitation is a possible ceiling effect noted with the self-efficacy scale. Although the scale is designed to capture feelings of confidence about one task at one point in time, some participants at every time point had ratings of 10 (the highest point on the scale). Because this study assessed change over time, it is possible that a ceiling effect occurred and participants were not able to demonstrate improvement in self-efficacy beliefs.

5.4 SUGGESTIONS FOR FUTURE RESEARCH

This project did not indicate that self-efficacy was a strong predictor of performance. There are conflicting research results in the literature about self-efficacy and its predictive ability (Bandura & Locke, 2003; Barnsley et al., 2004; Colquitt et al., 2000; Davis et al., 2006; Leopold et al., 2005; Salas & Canon-Bowers, 2001; Stajkovis & Luthans, 1998). Further investigation of self-efficacy's influence on performance assessments is needed to determine if there is a difference between self-efficacy ratings and cognitive task performance versus self-efficacy ratings and motor task performance. Indeed, further study is needed to explore possible causes of the sensitivity of each scenario to predict performance, as the Urinary scenario was predictive but the other scenarios were not.

The performance assessment tool used in this study was created specifically for this project. It has the advantage of being easy to use because of its targeted, objective operational criteria. However, it is the only measure of performance used in this study. There are other transfer assessment methods used both clinically and in research. Further study determining the validity and reliability of this assessment in comparison to others would determine the feasibility of continued use of this tool.

This study followed second year MOT participants for several months. During the final phase of this study participants were engaged in clinical fieldwork. Although this study was designed to assess critical thinking with medically complex patients, not all fieldwork experiences were in an acute care environment, nor did all fieldwork experiences serve a medically complex population. Fieldwork may not have afforded opportunities for additional patient handling practice and exposure. This project did not control for a lack of exposure to patient transfers or inconsistent, discontinuous patient transfer experiences during fieldwork. Additional study is needed to determine if the amount of patient handling exposure affects participant self-efficacy ratings.

Finally, quick critical thinking is an important part of effective clinical intervention (Elfrink et al, 2010; Gordon et al., 2010), especially with a medically fragile population. Simulation offers a real-time situation infused with emotion, content, context and participation (Elfrink et al., 2010). Performance skills are altered in the presence of extreme emotion (Gordon et al., 2010), and this project included specific critical events embedded in each scenario that required participants to control emotions and reason through their actions to ensure that a planned response would occur. In most cases this was by management of equipment or vigilant attention to the vital signs data on the monitors which reflected the medical stability of the simulator. Data analysis in this project did not target these critical event skills. Data analysis in this project focused on performance of the procedural skills and the critical event skills combined. Future analysis will examine the relationship between self-efficacy and the four critical event criteria embedded in each simulation to determine how effective simulation is in developing reasoning and confidence.

APPENDIX A

PHASE I: PERFORMANCE ASSESSMENT CRITERIA

Transfer Training Instructions
Dependent Style Transfer

Student Name: ____

Patient Problem (SCI, TBI, CVA, generalized weakness, etc.):

0=NO   1=YES

	W/C is positioned and aligned correctly.
	W/C brakes are locked and W/C parts (arm rests & leg rests) managed appropriately.
	Therapist uses proper body mechanics during set up (back straight, knees bent, head erect)
	Patient is scooted to edge of bed or w/c and buttocks are angled in the direction he/she is being transferred.
	Patient's feet are positioned close together and underneath knees, and lower extremities are protected during transfer.
	Patient is positioned with arms folded in lap or around therapist’s waist.
	Therapist uses proper handling techniques.
	Therapist gives clear directions regarding patient's role in transfer.
	Therapist uses proper body mechanics during transfer (back straight, knees bent, head erect)
	Movement from bed-->w/c or w/c-->bed is smooth and controlled i.e., patient is pivoted onto the transferring surface in safe and controlled manner.

Total = _______/ 10

APPENDIX B

FINAL SCENARIO DESCRIPTIONS

Students will rotate between medical theater rooms at WISER to complete transfers embedded within the following scenarios.

- Each room is set up as a mock hospital room, and will contain a hospital bed, bedside table, over-bed table, and wheelchair. The technology is equivalent to that of a hospital and includes head of bed/over bed electrical systems and patient monitoring devices that can mimic any level of patient care acuity.
- Prior to beginning the intervention, students will receive a short vignette outlining the medical history, current condition, and treatment objective of the scenario.
- Each scenario will be ‘reset’ after the transfer, with all equipment placement the same at the start of the scenario.
- Each scenario has 3 overall aspects: a medical condition, a treatment objective and a critical event. The medical condition and treatment objective provide the context for the intervention, while management of the critical event provides a measure of competency.
- Students will have 10 minutes in the patient’s room to complete the transfer.
- Scenarios will begin when the student opens the door to patient’s room.
- Scenario Managers will tell the students when to enter the room.
- Assessment criteria will be used by faculty and peer reviewers to determine competency.
- In every scenario, all vital signs will be monitored (heart rate, respiratory rate, oxygen saturations, blood pressure).
- Supplies (wash basin, hygiene items, and clothes) will be located in each room near the patient and will be clearly visible to the students.
- Some scenarios will be computer programmed while others will not.
- Students will be given overall instructions regarding scenario components prior to attending WISER. These instructions will address infection control, equipment (wheelchair, electric bed, call bell, monitors, IV pump) management, emergency procedures (calling for the nurse) and management of invasive patient medical devices (lines, drains and tubes).

- Students teams actively participating in the simulation and completing the transfers will be given the brief vignettes that follow and this table, which is similar to one used by acute care therapists, to track pre-intervention and post-intervention vital signs.

B.1 POST-OPERATIVE SCENARIO

Mr. Smith has had an accident at a construction site and has suffered internal trauma. He now has a Jackson-Pratt abdominal drain. **You are going to transfer him out of bed and into a wheelchair so that he can change into clean hospital clothing before his family visits.**

Patient Name		Room Number
Vital signs:	Pre-treatment:	Post-treatment:
HR		
RR		
Ox Sat		
BP		

Scenario Set-up:
- Starting position supine with head of bed elevated to 30 degrees.
- Jackson-Pratt drain pinned to bed sheet on mattress between the hand and body of the patient, close to the edge of the bed and on the opposite side of where the student will be standing to complete the transfer.
- Wash basin on bedside table with hospital gown in it
- Unlocked wheelchair at foot of bed
- Non-programmed

Critical Event:
- Incorrect handling techniques of Jackson-Pratt post-operative surgical drain

Equipment Needed:
- Jackson-Pratt drain
- Basin with Hospital gown
- Standard wheelchair with leg rests

■	YES	NO	ASSESSMENT CRITERIA: **POST-OPERATIVE SCENARIO**
1			Proper infection control procedures are followed (hands are washed).
2			Vital signs are recorded at start of session.
3			W/C is positioned as close to the bed as possible.
4			W/C brakes are locked and w/c stability is checked prior to beginning transfer.
5			Leg rests and arm rests are removed or swung out of the way.
6			Clear directions regarding patient's role in transfer are given.
7			Patient is moved supine to sit safely (via elevation of the head of the bed, or safe manual handling techniques).
8			***Drain is unclipped from bed linens prior to any patient movement.***
9			***Drainage clip/safety pin is moved to gown while transferring patient.***
10			Bed height is adjusted to allow the patient’s feet to touch the floor.
11			Upright posture of the patient is supported by using proper hand placement that prevents a loss of balance on the edge of the bed.
12			Patient is scooted to edge of bed with buttocks remaining on mattress.
13			Movement from bed→w/c is done in a smooth and controlled manner, with no jarring or sudden movements.
14			Proper body mechanics are used during transfer (back straight, knees bent, head erect).
15			***Drain and tubing are kept slack/loose (are not pulled/do not become taut).***
16			***Drain is pinned below the level of abdominal insertion to allow for gravity assisted drainage.***
17			Leg rests and arm rests are replaced.
18			Vital signs are recorded at end of session.
■		■	**Final Score** (total possible=18)

If criteria are not met, please provide specific comments regarding the types of errors noted:______________________________________

____

____

B.2 RESPIRATORY SCENARIO

Mr. Murphy has had a cardiac arrest and now has a tracheostomy and is on humidified oxygen at 5 liters per minute. **You are going to transfer him out of bed and into a wheelchair so that he can change into clothes his family has brought from home.**

Patient Name		Room Number
Vital signs:	Pre-treatment:	Post-treatment:
HR		
RR		
Ox Sat		
BP		

Scenario Set-up:

- Starting position supine with head of bed elevated to 30 degrees.
- Humidified air has condensed in tracheostomy tubing coming from wall oxygen and must be removed prior to beginning treatment, by lifting tubing to drain the water back into the humidifier, or by disconnecting the tubing and draining the water onto a washcloth.
- Wash basin on bedside table with street clothes in it
- Unlocked wheelchair at foot of bed
- Non-programmed

Critical Event:

- Allowing water to enter the tracheostomy

Equipment Needed:

- Tracheostomy with oxygen and humidification
- Basin with street clothes
- Standard wheelchair with leg rests

	YES	NO	ASSESSMENT CRITERIA: **RESPIRATORY SCENARIO**
1			Proper infection control procedures are followed (hands are washed).
2			Vital signs are recorded at start of session.
3			W/C is positioned as close to the bed as possible.
4			W/C brakes are locked and w/c stability is checked prior to beginning transfer.
5			Leg rests and arm rests are removed or swung out of the way.
6			Clear directions regarding patient's role in transfer are given.
7			***Water is distributed back into reservoir or onto washcloth on bedside table before patient movement.***
8			Patient is moved supine to sit safely (via elevation of the head of the bed, or safe manual handling techniques).
9			Patient is scooted to edge of bed with buttocks remaining on mattress.
10			Bed height is adjusted to allow the patient’s feet to touch the floor.
11			Upright posture of the patient is supported by using proper hand placement that prevents a loss of balance on the edge of the bed.
12			Movement from bed→w/c is done in a smooth and controlled manner, with no jarring or sudden movements.
13			Proper body mechanics are used during transfer (back straight, knees bent, head erect).
14			***No water is allowed to enter the airway through the tracheostomy.***
15			***Oxygenated airway patency is maintained during transfer (tubing does not become dislodged).***
16			***Oxygenated airway tubing is kept slack/loose (is not pulled taut).***
17			Leg rests and arm rests are replaced
18			Vital signs are recorded at end of session.
			Final Score (total possible=18)

If criteria are not met, please provide specific comments regarding the types of errors noted:____

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B.3 CHRONIC MEDICAL SCENARIO

Mr. Williams has had multiple medical problems following brain surgery including syncope. **You are going to transfer him out of bed and into a wheelchair so that he can wash his face and brush his teeth thoroughly, something he says he wants to do and has not yet been able to do today.**

Patient Name		Room Number
Vital signs:	Pre-treatment:	Post-treatment:
HR		
RR		
Ox Sat		
BP		

Scenario Set-up:

- Starting position supine with head of bed flat
- Wash basin on bedside table with toothbrush, toothpaste, washcloth, soap, and comb.
- Programmed as follows: As the student elevates the head of the bed or lifts the simulator to a sitting position, blood pressure readings will drop to 70/50. The simulator (via simulation specialist voice over), will state, “I feel dizzy”. If the student does not stop elevation of the patient’s upper body, or does not lay the patient back down, blood pressure readings will remain at 70/50. However, if the student reclines the patient or stops elevation of the patients upper body, the vital signs with return to normal (standard). After waiting 5-15 seconds, the simulator will say (via simulation specialist voice over), “OK, I feel better now. I think I can get up.”
- Unlocked wheelchair at foot of bed

Critical Event:

- Incorrect management of postural hypotension

Equipment Needed:

- Basin with toothbrush, paste, washcloth, soap, comb
- Standard wheelchair with leg rests

	YES	NO	ASSESSMENT CRITERIA: **CHRONIC MEDICAL SCENARIO**
1			Proper infection control procedures are followed (hands are washed).
2			Vital signs are recorded at start of session.
3			W/C is positioned as close to the bed as possible.
4			W/C brakes are locked and w/c stability is checked prior to beginning transfer.
5			Leg rests and arm rests are removed or swung out of the way.
6			Clear directions regarding patient's role in transfer are given.
7			***Head of patient is elevated slowly.***
8			***Observation of vital signs as head of patient is elevated.***
9			***Elevation is stopped until vital signs become stable again.***
10			***Scanning of monitors visually for vital signs as the patient is brought to full upright position.***
11			Patient is moved supine to sit safely (via elevation of the head of the bed, or safe manual handling techniques).
12			Patient is scooted to edge of bed with buttocks remaining on mattress.
13			Bed height is adjusted to allow the patient’s feet to touch the floor.
14			Upright posture of the patient is supported by using proper hand placement that prevents a loss of balance on the edge of the bed.
15			Movement from bed→w/c is done in a smooth and controlled manner, with no jarring or sudden movements.
16			Proper body mechanics are used during transfer (back straight, knees bent, head erect).
17			Leg rests and arm rests are replaced
18			Vital signs are recorded at end of session.
			Final Score (total possible=18)

If criteria are not met, please provide specific comments regarding the types of errors noted:____________________________________

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B.4 CARDIAC SCENARIO

Mr. Evans had a cardiac arrest and is being evaluated for pacemaker placement. **You are going to transfer him out of bed and into a wheelchair so that he can basin bathe.**

Patient Name		Room Number
Vital signs:	Pre-treatment:	Post-treatment:
HR		
RR		
Ox Sat		
BP		

Scenario Set-up:

- Starting position supine with head of bed elevated to 30°
- Wash basin on bedside table with washcloth, soap, and towel in it.
- Call bell will be on the upper side rail of the bed, on the side of the patient transfer.
- Programmed as follows: As the student puts the leg rests on the wheelchair, the heart rate will drop to 40 and the blood pressure will drop to 70/50. The student will need to use the call button to call for help. Once the student does use the call button the nurse (via simulation specialist voice over), will state: "Nurses station; how can I help you?" The student will have to explain to the nurse that the patient's heart rate is dropping. The nurse (via simulation specialist voice over), will respond, "OK, I'll be right down." and the scenario will be over.
- Unlocked wheelchair at foot of bed

Critical Event:

- Inability to recognize vital sign instability and to call for outside the room assistance

Equipment Needed:

- Basin with washcloth, soap, and towel
- Standard wheelchair with leg rests

	YES	NO	ASSESSMENT CRITERIA: **CARDIAC SCENARIO**
1			Proper infection control procedures are followed (hands are washed).
2			Vital signs are recorded at start of session.
3			W/C is positioned as close to the bed as possible.
4			W/C brakes are locked and w/c stability is checked prior to beginning transfer.
5			Leg rests and arm rests are removed or swung out of the way.
6			Clear directions regarding patient's role in transfer are given.
7			Patient is moved supine to sit safely (via elevation of the head of the bed, or safe manual handling techniques).
8			Patient is scooted to edge of bed with buttocks remaining on mattress.
9			Bed height is adjusted to allow the patient’s feet to touch the floor.
10			Upright posture of the patient is supported by using proper hand placement that prevents a loss of balance on the edge of the bed.
11			Movement from bed→w/c is done in a smooth and controlled manner, with no jarring or sudden movements.
12			Proper body mechanics are used during transfer (back straight, knees bent, head erect).
13			***Notes that vital signs are not stabilizing.***
14			***Nurse is called.***
15			***The change in patient condition is calmly and accurately reported over the call system.***
16			***The patient is reassured that the nurse is being called.***
17			Leg rests and arm rests are replaced
18			Vital signs are recorded at end of session.
			Final Score (total possible=18)

If criteria are not met, please provide specific comments regarding the types of errors noted:____________________________________

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B.5 URINARY SCENARIO

Mr. Wiley is status-post kidney transplant, and has a urinary catheter and has been complaining of bladder pain and pressure. You are going to transfer him out of bed and into a wheelchair so that he can change from his hospital gown into street clothes in preparation for attendance in the OT/PT gym.

Patient Name		Room Number
Vital signs:	Pre-treatment:	Post-treatment:
HR		
RR		
Ox Sat		
BP		

Scenario Set-up:

- Starting position supine with head of bed elevated to 30°
- Wash basin on bedside table with street clothes in it.
- Foley catheter tubing leading to standard (non-leg) collection bag hooked on the non-transfer side of the bed with some apple cider to simulate urine in it.
- Non-programmed
- Unlocked wheelchair at foot of bed

Critical Event:

- Inability to manage Foley catheter correctly.

Equipment Needed:

- Basin with street clothes
- Foley catheter tubing and collection bag, not a leg bag.
- Standard wheelchair with leg rests
- Apple cider

	YES	NO	ASSESSMENT CRITERIA: **URINARY SCENARIO**
1			Proper infection control procedures are followed (hands are washed).
2			Vital signs are recorded at start of session.
3			W/C is positioned as close to the bed as possible.
4			W/C brakes are locked and w/c stability is checked prior to beginning transfer.
5			Leg rests and arm rests are removed or swung out of the way.
6			Clear directions regarding patient's role in transfer are given.
7			Patient is moved supine to sit safely (via elevation of the head of the bed, or safe manual handling techniques).
8			***Catheter bag is unhooked from bed frame and moved to transfer side of bed.***
9			Patient is scooted to edge of bed with buttocks remaining on mattress.
10			Bed height is adjusted to allow the patient’s feet to touch the floor.
11			Upright posture of the patient is supported by using proper hand placement that prevents a loss of balance on the edge of the bed.
12			Movement from bed→w/c is done in a smooth and controlled manner, with no jarring or sudden movements.
13			Proper body mechanics are used during transfer (back straight, knees bent, head erect).
14			***Catheter bag and tubing are kept slack/loose (are not pulled/do not become taut).***
15			***Catheter bag is immediately repositioned under wheelchair after patient transfer is complete.***
16			***Tubing is checked to assure full drainage from bladder into catheter bag (tubing is not kinked or twisted).***
17			Leg rests and arm rests are replaced
18			Vital signs are recorded at end of session.
			Final Score (total possible=18)

If criteria are not met, please provide specific comments regarding the types of errors noted:____________________________________

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B.6 PULMONARY SCENARIO

Mr. Anderson has chronic obstructive pulmonary disease, has been on 3 liters of oxygen for many months, and is recovering from a pulmonary embolism. **You are transferring him out of bed to comb his hair in preparation to go to the OT gym for further intervention. He is on wall oxygen and will need to be transferred to a portable oxygen tank for transport.**

Patient Name		Room Number
Vital signs:	Pre-treatment:	Post-treatment:
HR		
RR		
Ox Sat		
BP		

Scenario Set-up:

- Starting position supine with head of bed elevated to 30°
- Wash basin on bedside table with comb in it.
- Wall oxygen at 3 liters per minute via nasal cannulae
- Non-programmed
- Unlocked wheelchair at foot of bed

Critical Event:

- Inability to disconnect wall oxygen and reconnect to portable oxygen.

Equipment Needed:

- Basin with street clothes
- Wall oxygen and tubing, all connectors
- Standard wheelchair with leg rests
- Portable oxygen tank and holder, all connectors and regulator.

	YES	NO	ASSESSMENT CRITERIA: **PULMONARY SCENARIO**
1			Proper infection control procedures are followed (hands are washed).
2			Vital signs are recorded at start of session.
3			W/C is positioned as close to the bed as possible.
4			W/C brakes are locked and w/c stability is checked prior to beginning transfer.
5			Leg rests and arm rests are removed or swung out of the way.
6			Clear directions regarding patient's role in transfer are given.
7			***Portable oxygen tank is placed next to wheelchair or in wheelchair holder in preparation for transfer.***
8			Patient is moved supine to sit safely (via elevation of the head of the bed, or safe manual handling techniques).
9			Patient is scooted to edge of bed with buttocks remaining on mattress.
10			Bed height is adjusted to allow the patient’s feet to touch the floor.
11			Upright posture of the patient is supported by using proper hand placement that prevents a loss of balance on the edge of the bed.
12			Movement from bed→w/c is done in a smooth and controlled manner, with no jarring or sudden movements.
13			Proper body mechanics are used during transfer (back straight, knees bent, head erect).
14			***Student therapist explains to patient, without using medical jargon, that he/she is going to disconnect the wall oxygen and reconnect to portable oxygen, BEFORE beginning the oxygen transition.***
15			***Portable oxygen tank liters per minute are accurately adjusted to match wall oxygen liters per minute.***
16			***Patient’s oxygen access is disrupted for less than 60 seconds.***
17			Leg rests and arm rests are replaced
18			Vital signs are recorded at end of session.
			Final Score (total possible=18)

If criteria are not met, please provide specific comments regarding the types of errors noted:____________________________________

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B.7 IV MANAGEMENT SCENARIO

Mr. Ott has had a myocardial infarction and has an IV line with a port in his left forearm. **The nurse told you Mr. Ott's IV cannot be shut off. You are transferring him out of bed to go to the bathroom to toilet and brush his teeth. You must unplug the IV pump so that he can take it with him.**

Patient Name		Room Number
Vital signs:	Pre-treatment:	Post-treatment:
HR		
RR		
Ox Sat		
BP		

Scenario Set-up:

- Starting position supine with head of bed elevated to 30°
- Wash basin on bedside table with soap, washcloth and towel in it.
- IV pole with IV in forearm. IV pole and site will be on the opposite side of the transfer, so that the student will have to unplug the pole before beginning the transfer.
- The IV will be plugged into a grouping of several outlets, such as what you would see at the head of a patient's bed. All outlets will be in use, so that the student will have to be careful that they are only unplugging the IV from the electrical outlet, and not something else, like the electric bed or another type of monitoring device.
- Non-programmed
- Unlocked wheelchair at foot of bed

Critical Event:

- Inability to manage IV

Equipment Needed:

- Basin with soap, washcloth and towel
- IV set up including tubing and IV pole
- Standard wheelchair with leg rests

	YES	NO	ASSESSMENT CRITERIA: **IV MANAGEMENT SCENARIO**
1			Proper infection control procedures are followed (hands are washed).
2			Vital signs are recorded at start of session.
3			W/C is positioned as close to the bed as possible.
4			W/C brakes are locked and w/c stability is checked prior to beginning transfer.
5			Leg rests and arm rests are removed or swung out of the way.
6			Clear directions regarding patient's role in transfer are given.
7			***The correct equipment is unplugged (hands are walked backward from the IV pump to the plug).***
8			***IV line is protected by moving the pole around the bed in a controlled manner prior to transfer.***
9			***IV pole is placed out of the way (the IV pole and pump do not present a physical barrier during the transfer)***
10			Patient is moved supine to sit safely (via elevation of the head of the bed, or safe manual handling techniques).
11			Patient is scooted to edge of bed with buttocks remaining on mattress.
12			Bed height is adjusted to allow the patient’s feet to touch the floor.
13			Upright posture of the patient is supported by using proper hand placement that prevents a loss of balance on the edge of the bed.
14			Movement from bed→w/c is done in a smooth and controlled manner, with no jarring or sudden movements.
15			Proper body mechanics are used during transfer (back straight, knees bent, head erect).
16			***IV site integrity is maintained (the IV line remains intact and is not dislodged or disconnected).***
17			Leg rests and arm rests are replaced
18			Vital signs are recorded at end of session.
			Final Score (total possible=18)

If criteria are not met, please provide specific comments regarding the types of errors noted:____________________________________

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APPENDIX C

SELF-EFFICACY RATING SCALES

SELF-EFFICACY FOR PATIENT HANDLING (TRANSFERS)

PHASE I QUESTIONS (AT THE END OF OT2113/OT2114 REVIEW UNIT)

1. **How certain are you that you have the <u>knowledge</u> that supports correct transfer techniques?**

VERY UNCERTAIN	1	2	3	4	5	6	7	8	9	10	VERY CERTAIN

2. **How certain are you that you have the <u>skills</u> that support correct transfer techniques?**

VERY UNCERTAIN	1	2	3	4	5	6	7	8	9	10	VERY CERTAIN

3. **How certain are you that you can <u>safely</u> transfer a patient from bed to wheelchair?**

VERY UNCERTAIN	1	2	3	4	5	6	7	8	9	10	VERY CERTAIN

4. **How certain are you that you have the <u>knowledge</u> to transfer medically fragile and clinically complex patients?**

VERY UNCERTAIN	1	2	3	4	5	6	7	8	9	10	VERY CERTAIN

5. How certain are you that you have the <u>skills</u> to transfer medically fragile and clinically complex patients?

VERY UNCERTAIN	1	2	3	4	5	6	7	8	9	10	VERY CERTAIN

6. How certain are you that you can <u>safely</u> transfer medically fragile and clinically complex patients?

VERY UNCERTAIN	1	2	3	4	5	6	7	8	9	10	VERY CERTAIN

7. How certain are you that WISER simulation experience will be effective for preparing you to transfer medically fragile and clinically complex patients?

VERY UNCERTAIN	1	2	3	4	5	6	7	8	9	10	VERY CERTAIN

SELF-EFFICACY FOR PATIENT HANDLING (TRANSFERS)
PHASE II QUESTIONS (AT THE END OF WISER SIMULATION UNIT)

1. **How certain are you that you have the <u>knowledge</u> to transfer medically fragile and clinically complex patients?**

VERY UNCERTAIN	1	2	3	4	5	6	7	8	9	10	VERY CERTAIN

2. **How certain are you that you have the <u>skills</u> to transfer medically fragile and clinically complex patients?**

VERY UNCERTAIN	1	2	3	4	5	6	7	8	9	10	VERY CERTAIN

3. **How certain are you that you can <u>safely</u> transfer medically fragile and clinically complex patients?**

VERY UNCERTAIN	1	2	3	4	5	6	7	8	9	10	VERY CERTAIN

4. **How certain are you that the WISER simulation experience was effective for preparing you to transfer medically fragile and clinically complex patients?**

VERY UNCERTAIN	1	2	3	4	5	6	7	8	9	10	VERY CERTAIN

SELF-EFFICACY FOR PATIENT HANDLING (TRANSFERS)
PHASE III QUESTIONS (AT THE END OF THE TERM)

1. **How certain are you that you have the <u>knowledge</u> to transfer medically fragile and clinically complex patients?**

VERY UNCERTAIN	1	2	3	4	5	6	7	8	9	10	VERY CERTAIN

2. **How certain are you that you have the <u>skills</u> to transfer medically fragile and clinically complex patients?**

VERY UNCERTAIN	1	2	3	4	5	6	7	8	9	10	VERY CERTAIN

3. **How certain are you that you can <u>safely</u> transfer medically fragile and clinically complex patients?**

VERY UNCERTAIN	1	2	3	4	5	6	7	8	9	10	VERY CERTAIN

4. **How certain are you that the WISER simulation experience was effective for preparing you to transfer medically fragile and clinically complex patients?**

VERY UNCERTAIN	1	2	3	4	5	6	7	8	9	10	VERY CERTAIN

SELF-EFFICACY FOR PATIENT HANDLING (TRANSFERS)
(AFTER LEVEL II FIELDWORK)

1. How certain are you that you had the <u>knowledge</u> to transfer medically fragile and clinically complex patients?

VERY UNCERTAIN	1	2	3	4	5	6	7	8	9	10	VERY CERTAIN

2. How certain are you that you had the <u>skills</u> to transfer medically fragile and clinically complex patients?

VERY UNCERTAIN	1	2	3	4	5	6	7	8	9	10	VERY CERTAIN

3. How certain are you that you <u>safely</u> transferred medically fragile and clinically complex patients?

VERY UNCERTAIN	1	2	3	4	5	6	7	8	9	10	VERY CERTAIN

4. How certain are you that the WISER simulation experience was effective for preparing you to transfer medically fragile and clinically complex patients?

VERY UNCERTAIN	1	2	3	4	5	6	7	8	9	10	VERY CERTAIN

5. What issues did you face while transferring patients that were not addressed in class or during the simulations at the WISER?

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