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THE EFFECTS OF EMERGENCY CARDIOVASCULAR CARE HIGH FIDELITY SIMULATION ON ATHLETIC TRAINING STUDENTS’ PERCEIVED SELF-EFFICACY

By

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A DISSERTATION IN PRACTICE

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Abstract

The purpose of this quantitative quasi experimental study was to investigate the effect an emergency cardiovascular care high fidelity simulation had on the perceived self-efficacy of athletic training students. Bandura’s self-efficacy theory was used as the theoretical framework of the study. Outcomes of high fidelity simulation especially related to the response of medical and health care providers to cardiovascular emergencies was significant in developing the study. Forty-six undergraduate athletic training students participated in this study and were randomly divided into either a simulation participation or simulation observation group using the Laerdal® SimMan. Perceived self-efficacy in performing emergency cardiovascular care was measured using the Emergency Cardiovascular Care Appraisal Inventory (ECCAI) and was assessed for all participants prior to the simulation, immediately following the simulation debriefing, and six months following the simulation. Both participation in and observation of a high fidelity CPR simulation had a significant positive effect on the athletic training students’ self-efficacy though there were no differences in self-efficacy gains between the groups. Additionally, there was a significant increase in perceived self-efficacy of athletic training students in both the participation and observation group at six months after completion of a high fidelity CPR simulation. It is recommended that when feasible, annual high fidelity cardiovascular emergency simulation be incorporated into professional athletic training programs.

Keywords: Cardiopulmonary Resuscitation, healthcare competency, confidence gains
Dedication

The author would like to dedicate this work to Mr. Mark Trgovich and Mrs. Judith Paloney who both instilled the value of education and have provided her with unwavering strength and love throughout life.
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CHAPTER ONE: INTRODUCTION

Competency in Cardiopulmonary Resuscitation Ability among HealthCare Providers

Over the past two decades, simulation technology as a teaching and training method has been increasingly incorporated into educational and training curricula in medical and health programs (Rosen, 2008). Evidence in medical and nursing education demonstrates one significant advantage of simulation in training is that participants are provided with deliberate practice opportunities for high risk skills in a safe environment (Lasater, 2007; Wayne, Butter, Siddall, Fudala, Wade, Feinglass, & McGaghie, 2006). Lasater (2007) and Wayne et al. (2006) stated participants can improve clinical performance through repeated practice of an appropriate response to a specific clinical situation through a simulation. This becomes especially important for individuals trying to improve clinical performance with skills that involve low incidence, or rarely occurring, high risk clinical events such as breathing and cardiac emergencies.

Simulation has commonly been incorporated into medical and health education programs to supplement clinical teaching and improve clinical learning in low incident events (Gordon & Buckley, 2009).

The level of fidelity, or realism, of a medical simulation affects the participants’ ability to effectively suspend reality and become immersed in a scenario (Akaike, Fukutomi, Nagamune, Fujimoto, Tsuji, Ishida, & Iwata, 2012). Low fidelity simulations include components such as task trainers with low output capabilities and anatomical models. These rarely provide a sufficient level of realism for the participant to become fully immersed in a scenario.
The current method of teaching and Emergency Cardiac Care (ECC) certification of athletic trainers (ATs) and athletic training students (ATSs) include skills practice on task trainers such as Rescue-Annie (Rosen, 2008). Rosen (2008) states that this is a simple model with a plastic head and a foam torso that is used internationally for the practice and skill assessment of mouth-to-mouth breathing and chest compressions. When low fidelity task trainers such as this are used, participants must rely on the instructor to provide vital sign information and effectiveness of skill application. For instance, the participant may place their fingers over the carotid artery on the lateral aspect of the mannequin’s neck to indicate they would feel for a pulse, but the plastic head and torso does not actually have the ability to produce a palpable pulse for the participant to feel. Therefore, the action of the participant prompts the instructor to give information about what they are feeling in that particular scenario. The instructor may inform the participant that the patient ‘has a pulse,’ ‘does not have a pulse,’ ‘has a weak pulse,’ etc. Based on the instructor prompts, the participant is then able to decide what skill to perform based on the needs of the simulated patient. This method of ECC instruction has been demonstrated to achieve task competence but does not allow for a student to experience a life-like scenario involving this knowledge and skills (Glavin & Maran, 2003).

In contrast, high fidelity mannequins are capable of producing human physiological responses such as palpable pulses, heart, lung, and bowel sounds, voice sounds, and breathing patterns. As the level of fidelity in a simulation increases, the participant is more easily able to actively engage in life-like experiences (Scherer, Bruce,
Graves, & Erdley, 2003). This process can allow for classroom knowledge to be effectively transitioned into clinical decision making experience (McFetrich, 2006).

The majority of studies examining high fidelity simulation have concluded that among other gains, participants’ self-efficacy increases following simulation (Blum, Borgia, & Parcells, 2010; Opacic, 2003; Wagner, Bear, & Sander, 2009). Personal efficacy, perceived self-efficacy, or self-efficacy has been most developed by Bandura (1977) through his studies of social cognitive theory. Self-efficacy is described as an individual’s belief that he or she has the capabilities to perform actions necessary to achieve a given effect (Bandura, 1977). This is as a result of successful experiences within a certain task as well as having the cognitive knowledge to be successful (Bandura, 1977). General agreement among educators is that success in clinical practice is not only dependent on educational training, but also includes nonacademic factors such as self-efficacy that influence performance (Opacic, 2003). Bandura (1977) describes that a relationship has been established between self-efficacy and successful performance. Simply put, enhanced self-efficacy translates to an increased confidence to apply skills in real clinical situations.

In a description of performance self-efficacy, Bandura and Cervone (1986) state that the level of perceived self-efficacy can be both influenced and changed. Four sources of information contribute to the self-knowledge of an individual which affects personal self-efficacy: performance attainment, vicarious experiences, verbal persuasion, and personal physiological status (Zimmerman, 1995). In an exploration of Bandura’s self-efficacy theory, Zimmerman (1995) explains that an increased confidence or perceived self-efficacy fosters an individual’s level of engagement in learning activities which, in
turn, promotes the development of educational competencies. Therefore, self-efficacy not only affects the level of competency, or achievement, but also the level of motivation for a task. This current study was grounded in the idea that enhanced self-efficacy of athletic training students results in increased confidence to apply the knowledge and skills they learn in the classroom to real-life clinical situations.

Professional competency is embedded into all medical and health care educational programs and subsequent professional practice (Ericsson, 2004; Wass, Van der Vleuten, Shatzer, & Jones, 2001). Studies widely report that clinical competence deteriorates rapidly over periods of time where the skill or knowledge is not being used (Davies & Gould, 2000; Scalese, Obeso, & Issenberg, 2008). This is one factor that prompts the integration of clinical experiences into health care educational programs. When a student is provided with deliberate practice opportunities in a clinical environment, clinical competence and clinical performance can be developed and maintained (Ericsson, 2004).

The most common way that ATSs gain performance competence is by actually participating in real-world encounters in the clinical setting. As part of all athletic training education programs, athletic training students are assigned to clinical sites where they are under the supervision of a preceptor who is usually a certified athletic trainer (Arnheim & Prentice, 2000). Therefore, both ATs and ATSs tend to share real-world encounters in the clinical setting. However, opportunities for ATSs to perform low incidence skills such as CPR in a clinical setting are rare. Due to the severity of the case, if an event requiring CPR does occur in a clinical experience, the ATSs tend to be relegated to either an observer role or participate under the strict supervision of their preceptor (Tivener & Gloe, 2015). High fidelity simulation can provide an ideal adjunct to the clinical or real-
world experience by providing a realistic and safe learning environment for the practice of low incident encounters (Lasater, 2007; Scherer et al., 2003).

Statement of the Problem

Inherent to the profession of athletic training is the ability to manage on-the-field emergency events appropriately. One of these emergency events includes rarely occurring but high risk (life-threatening) situations involving emergency cardiovascular care. Certified athletic trainers and athletic training students are required to maintain ECC certification in order to practice as health care providers (Commission on Accreditation of Athletic Training Education, n.d.). Typical ECC certification, often referred to as Healthcare Provider Cardiopulmonary Resuscitation (CPR), consists of a course that includes passive lecture and one-time skill stations followed by successful completion of both a written examination and practical assessment using static or low fidelity task trainer models. ECC certification courses may be offered by a variety of providers but all approved athletic training related providers adhere to the *International Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care* (Board of Certification, 2016). The expectation after ECC certification is the ability of the provider to perform the correct sequence of interventions to provide initial management of cardiovascular emergencies (Sahu & Lata, 2010).

When these cardiovascular emergency encounters do occur, they are considered high risk in that the athlete’s life is in jeopardy. In an investigation of the incidence and etiology of death in NCAA athletes, a total of 514 student athletes died from 2003-2013 out of the 4,242,519 total athletes (Harmon, et al., 2015). In other terms, according to Van Camp, Bloor, Mueller, Cantu, & Olson (1995), the incidence of sudden cardiac death
requiring emergency cardiovascular care in high school athletes is estimated to be 1:100000 to 1:200000. According to Harmon et al. (2015), second to accidents, medical causes accounted for 147 (29%) of these student athlete deaths and 79 of those were due to sudden cardiac death.

Due to the low incidence of cardiovascular emergencies within athletic training, students may not have the opportunity to practice these skills in a clinical environment during their education (Tivener & Gloe, 2015). It is of particular concern that the athletic trainer and athletic training students develop both skill and confidence in managing cardiovascular emergencies since these rarely occurring clinical events involve competency with saving the life of a victim.

Though literature on many medical and healthcare professionals demonstrates high fidelity simulation to be an effective mode of providing opportunities to develop self-efficacy and skill competency in low incident events, studies within athletic training are limited. Given the unique nature of athletic training settings, what isn’t known is whether emergency cardiovascular high fidelity simulation will cause increases in self-efficacy ratings for athletic training students.

**Purpose of the Study**

Given that levels of perceived self-efficacy are malleable and high fidelity simulation can provide many positive outcomes, the purpose of this quantitative quasi experimental study was to determine whether participation in a high fidelity simulated cardiovascular emergency scenario using the Laerdal® SimMan increased undergraduate athletic training students’ self-efficacy scores in a university simulation center in the United States.
Central Research Question

Participants were randomly assigned into two groups; one group containing participants who actively contributed to the scenario and the other group containing participants who observed their peers contributing to the scenario. The examination of these two groups was important to this study because the researcher hoped to identify whether performance attainment or vicarious experiences were factors contributing to significant differences in self-efficacy.

The second part of this study adds a longitudinal component to the research. Six months after the simulation, the two groups were again surveyed to evaluate their perceived self-efficacy. The examination of self-efficacy ratings over time is important to this study because it identified the length of time following a simulation where possible self-efficacy outcomes were retained.

Self-efficacy is defined as “people’s judgements of their capability to organize and execute the courses of action required to attain designated types of performances” (Bandura & Cervone, 1986, p. 391). Therefore, the central question for this study was: What is the difference in self-efficacy scores of athletic training students prior to and following participation or observation in a high fidelity cardiovascular emergency scenario utilizing the Laerdal® SimMan?

Hypotheses

Specifically related to the central research question in this quantitative quasi experimental study design, the following three hypotheses were investigated;

Hypothesis 1: Participation in or observation of a high fidelity cardiovascular emergency simulation will increase self-efficacy among all participants and observers.
Hypothesis 2: Those who participate in a high fidelity cardiovascular emergency simulation will have higher self-efficacy scores than those who observe the simulation.

Hypothesis 3: High fidelity simulation effects on self-efficacy ratings will persist at 6 months after participation in or observation of a high fidelity cardiovascular emergency simulation.

**Aim of the Study**

The aim of this study was to design an evidence-based solution to provide deliberate practice opportunities to athletic training students that would result in increased perceived self-efficacy relating to emergency cardiovascular care.

**Methodology Overview**

The study used a pretest-posttest repeated measures quantitative quasi experimental design to evaluate the effects of a high fidelity cardiovascular emergency simulation on athletic training students’ self-efficacy scores. The Emergency Cardiovascular Care Appraisal Inventory (ECCAI) survey instrument was developed for this dissertation in practice with the purpose of measuring perceived self-efficacy scores related to actions occurring in a cardiovascular emergency.

The study used a convenience sample of undergraduate athletic training students recruited from a Commission on Accreditation of Athletic Training Education (CAATE)-accredited university program in the Midwest. After being randomly assigned to either a participation or observation group, student-participants in both groups completed the ECCAI survey which served as the pretest self-efficacy score. Next, based on their group assignment, they either participated in or observed a high fidelity emergency cardiovascular simulation using the Laerdal® SimMan in the university’s simulation
center. Immediately following the simulation, all participants (participation and observation group) completed the ECCAI survey which served as the posttest self-efficacy score in this form of repeated measures study design. Finally, six months after the simulation, all participants again completed the ECCAI survey which served as the posttest self-efficacy score over time.

Demographic information to include age, gender, length of time ECC certified, and prior experience with real-life cardiovascular emergencies and simulations was collected.

**Definition of Relevant Terms**

*Cardiovascular Emergency* – “Life-threatening disorders that must be recognized immediately to avoid delay in treatment and minimize morbidity and mortality. Patients may present with severe hypertension, chest pain, dysrhythmia, or cardiopulmonary arrest” (Elshazly & Nissen, 2014, p. 1.).

*Laerdal® 3G SimMan* – “A realistic, full-body, adult, wireless patient simulator with high level fidelity offering comprehensive clinical functional ability” (Laerdal Medical Products, 2012, p. 65) designed to meet the needs of emergency cardiac care and response scenarios including programmable airway, breathing, cardiac, and circulation management.

*High Fidelity Emergency Cardiovascular Simulation* – A developed scenario using a high fidelity mannequin that requires the participant to respond to a pulseless and lifeless victim.
Athletic Training Students – Undergraduate college students formally admitted into a professional Commission on Accreditation of Athletic Training Education accredited program.

Clinical Competence – “The quality of being functionally adequate, or of having sufficient knowledge, judgment, skill or strength for a particular duty” (Miller, 1990, p. 63).

Self-Efficacy – an individual’s “judgements of their capabilities to organize and execute the courses of action required to attain designated types of performances” (Bandura & Cervone, 1986, p. 391).

Limitations, Delimitations, and Personal Biases

The following limitations were applied to this study:

1. The study was limited to a small convenience sample size at one university in the Midwest which may not be a true random sample of all undergraduate athletic training students.

2. Participants only participated or observed one emergency cardiovascular simulation scenario. This may provide a limited view of the overall perceived self-efficacy scores of the participants.

3. If the participants shared details about the simulation scenario with others that have not yet participated, it could have contaminated the results of the study. All students were asked by the researcher to not share details about the simulation with others that had not participated.

4. It is assumed that all participants responded accurately and honestly to the pretest and posttests.
The following delimitations were applied to this study:

1. The small, convenience sample included undergraduate athletic training students. While other medical and health programs may require ECC skills, the final results may not be generalizable to other professional programs.

2. The study occurred at one simulation center in the Midwest with participants from the same university athletic training program. The fact that it is not a multi-centered approach may limit the significance of this study related to other settings that may use different educational methods.

Personal biases have the potential to influence a researcher’s study if they are not adequately understood and subsequently controlled. Within this dissertation in practice, I had the personal biases from being both an educator within an athletic training program as well as a certified athletic trainer. My experience as a certified athletic trainer may have influenced how I thought about a real-life cardiovascular emergency encounter. Additionally, my experience as an athletic training educator may have influenced how I thought about the design of the simulation scenario.

The quantitative study design utilizing the ECCAI survey instrument was used to control my personal biases. The ECCAI survey instrument was developed using Bandura’s guide for constructing self-efficacy scales (Bandura, 2006). According to this guide, if this approach is taken in constructing a survey instrument, it reduces biases on how to measure perceived self-efficacy as well as minimizes response biases (Bandura, 2006). Additionally, the quantitative approach was selected to control for the personal bias that may have occurred through the identification of themes within a qualitative study design.
Leader’s Role and Responsibility in Relation to Low Self-Efficacy in ECC

This Dissertation in Practice appropriately used the interdisciplinary nature of leadership theory. The problem identified in this proposed study was athletic training students lack the opportunity to gain self-efficacy in emergency cardiovascular care due to the low incidence of occurrence in clinical settings. Interdisciplinary leadership suggests using a strategic approach to study what tasks and resources have been successfully incorporated into similar environments and to use those in a planned approach to your problem (Thomson, Strickland, & Gamble, 2001).

Wells (2012) approaches the strategic planning process using a dynamic cycle including perceiving, understanding, and reasoning. Within this cycle, a leader perceives the problem by acquiring insight of what seems to be happening. This is similar to the approach that was taken in this study as I reviewed what was happening in current athletic training education which led to the identification of the problem.

From there, Wells (2012) suggests leaders identify strategic levers that may lead to competitive advantage. Opportunities such as high fidelity simulation were introduced to me as I studied the outcomes of this educational and training modality on medical and health programs. Through this, I was able to develop the understanding of what possibilities I face as a leader to address the problem using strategic levers that similar medical and healthcare fields have formed.

The final step in the strategic planning process is reasoning what action was taken and how it will work (Wells, 2012). It is essential that the leader moves forward in this process by providing clear direction while considering what will influence the motivation and behavior of those involved. The problem that was identified in this study and the
solution I moved forward on needs to engage a higher-level of influence to those followers it will affect. In short, I must influence if and why they will care about the solution.

Transformational leadership theory explains that true leadership arises from the ability to move past followers feeling an obligation to carry out the direction of the leader and engage because they feel inspired to want to (Haslam, Reicher, & Platow, 2013). I believe that my background as an athletic trainer and educator provided me with a platform to engage those followers by building a sense of commonality. Leadership is not just a relationship between leaders and followers, additionally it is a relationship that influences a social group (Haslam et al., 2013). My hope for this study was that my passion for finding a solution to this problem using high-fidelity simulation would be transparent and would lead to others to want to engage in the actions I have reasoned in this process.

**Significance of the Study**

The clinical performance for high risk, low incident encounters such as managing cardiovascular emergencies is of concern to ATs and ATSs. Self-efficacy facilitates knowledge and clinical performance (Murphy & Kraft, 1993). Bandura and Cervone (1986) explain that individuals who perceive they are capable of a successful performance are more likely to participate in tasks that occur within that self-efficacy range. Additionally, if an individual believes a task is beyond their self-perceived ability, they are more likely to avoid participation in that task. This relates to athletic training because if a student perceives they are inadequate at responding to a particular event, they may not apply certain skills or hesitate before providing treatment. This could
adversely affect patient outcomes especially in situations that require immediate response such as cardiovascular emergencies. Therefore, enhancing self-efficacy of athletic training students may improve patient outcomes.

This study is relevant to athletic training education because it evaluates the effects participation in a high fidelity simulation have on the malleable variable of self-efficacy. Athletic training educators must continually explore methods of instruction that increase knowledge, skill acquisition, and competency with clinical performance of athletic training students. Literature suggests that the use of high fidelity simulation is a way to provide medical and health care students with deliberate practice opportunities for low incident, high risk events such as cardiovascular emergencies (Perkins, 2007; Wayne et al., 2006). Despite the increased use of simulation in medical and health care programs, there is limited research on its application in athletic training education.

Summary

The purpose of this quantitative quasi experimental study was to investigate the effect that an emergency cardiovascular care high fidelity simulation had on the perceived self-efficacy of athletic training students. While the use of simulation in the education and training of medical and health professionals has been increasing over the past two decades, application within athletic training remains sparse. Within athletic training education, students participate in clinical rotations as a way to practice skills learned within the classroom in a real-world environment. Some of those skills, such as emergency cardiovascular care, are rarely occurring within traditional athletic training settings and therefore students may not have the chance to practice and gain the competency and the confidence needed to master these skills.
Given that self-efficacy is malleable, Bandura’s self-efficacy theory was used as the theoretical framework of the proposed study. Simulation used as an adjunct to clinical experiences may provide a way to give athletic training students a way to apply low incidence skills such as ECC in a simulated real-world environment in order to increase self-efficacy.
CHAPTER TWO: LITERATURE REVIEW

Introduction

The aim of this study was to design an evidence-based solution to provide deliberate practice opportunities to athletic training students that would result in increased perceived self-efficacy relating to emergency cardiovascular care. This section will provide the reader with literature on the history and outcomes of high fidelity simulation, emergency cardiovascular care competency outcomes, self-efficacy theoretical framework, as well as the application of self-efficacy theory to a variety of medical and health disciplines. The thorough investigation of these areas is crucial in the design of the current study as well as understanding the application of self-efficacy to performance enhancement in professional practice.

High Fidelity Simulation

Simulation has been successfully incorporated into the training of professionals in high risk performance environments such as pilots, astronauts, policeman, fireman, and military personnel dating back centuries (Goodman, 1978; Krebs, McCarley, & Bryant, 1999). One of the earliest examples of simulation in the military dates back to the game of chess in the sixth century, AD (Murray, 1913). Military leaders in many cultures used the game of chess as a simulated experience to strategize attack plans (Murray, 1913).

History of Medical Simulation

Medical simulation has been represented in various forms dating back centuries as well. For instance, physical anatomical models have been constructed long before the invention of modern plastics or computers as a way to study the human body including signs and symptoms of disease (Rosen, 2008). Innovations in plastics, technology, and
advances in flight simulation contributed to the evolution of medical simulation (Doherty-Restrepo & Tivener, 2014). However, the progression of medical simulation has been met with delayed acceptance due to skepticism, concepts in skill acquisition, and burden of proof (Buck, 1990). Only at the end of the 20th century has the concept of deliberate practice for the acquisition and retention of skills been applied to medical and healthcare education (Rosen, 2008). Until that point, it was not widely accepted among medical professionals and educators that practice contributed significantly to the learning and maintenance of skills.

The first medical specialists to use high fidelity simulation in teaching and skill acquisition were anesthesia, critical care, and emergency medicine in the late 1960s (Scalese, Obeso, & Issenberg, 2008). During this time, Abrahamson, Denson, & Wolf (1969) developed a mannequin that was able to have a programmable heartbeat, synchronized temporal and carotid pulses, blood pressure, and was able to breathe through a series of oxygen and nitrous oxide tubes. This mannequin used highly sophisticated technology for the time and was named Sim One (Abrahamson et al., 1969). Researchers did report some effectiveness in training with Sim One, however, ultimately this technology failed to achieve widespread acceptance (Bradley, 2006).

Two factors were determined to have most significantly accounted for the failure of Sim One. First, during this time, the apprenticeship-based model was widely accepted as the only necessary form of training for medical and surgical residents (Gaba, Howard, Fish, Smith, & Sowb, 2001). The apprenticeship-based model includes an academic split between completion of the program curriculum followed by clinical teaching (Flexner, 1910). Within this model, once medical students completed their program curriculum,
they were assigned to a senior clinician who led by having these students directly observe them as they practiced (Gaba et al., 2001). Students learned not by practicing skills themselves on patients, but observing the master, or senior clinician on how to perform competently (Osler, 1906). Sim One which was developed to supplement this clinical teaching phase was not viewed as necessary.

The second reason that Sim One failed was technology in the late 1960s did not support replicating the mannequin. Developers Abrahamson, Denson, and Wolf (1969) created a Sim One mannequin. Limitations at that time in technology did not allow more than just this one example to be produced (Bradley, 2006). In addition to limitations in technology, there were also financial reasons replication of the mannequin was not feasible and as a result, it was not available for mass production. The example mannequin failed because it could not be mass produced or available as a teaching and learning tool.

High fidelity simulation in medical and health education programs started to accelerate in the late 1980s and early 1990s (Rosen, 2008). During this time two factors prompted the more widespread use of high fidelity simulation; advances in computer technology and the development of minimally invasive surgical techniques. In the 1980s, two groups at universities in the United States developed simulation technology for anesthesia medical programs (Bradley, 2006). According to Gaba and DeAnda (1988), a group from Stanford University led by David Gaba developed a comprehensive anesthesia simulation environment (CASE). CASE utilized the latest technology to recreate the operating room environment for both research and training purposes rather than patient care. This Stanford University team focused significantly on the development of providing response teams opportunities to practice medical skills together in realistic
simulated environments (Gaba & DeAnda, 1988). This approach was borrowed from aviation team training in a model called crew resource management where teams were put into high stress simulated situations and had to work as a team to manage the outcome (Gaba, Howard, Fish, Smith, & Sowb, 2001). Eventually this team-based training led into a formal anesthesia crisis recourse management (ACRM) curriculum which has since been applied to other medical and health care crisis response teams (Bradley, 2006).

The second group to develop simulation technology during the 1980s was led by Michael Good and John Gravenstein from the University of Florida. While the Stanford group was focused on providing realistic environments to carry out team simulations, the University of Florida group was focused on developing an actual simulation device. According to Good and Gravenstein (1989), these individuals developed the Gainseville anesthesia simulator (GAS) which eventually became the Medical Education Technologies, Inc. (METI). The simulators from GAS (then METI) have formed the basis for what is considered today’s modern technology equipment used in moderate to high fidelity simulation (Gaba, Howard, Fish, Smith, & Sowb, 2001). Some of the technology advances this group applied to the simulation devices they developed were a realistic airway, respiratory chest and abdominal wall movements, synchronized breath, bowel, and heart sounds, and a variety of physiological outputs to standard monitors (Bradley, 2006; Good & Gravenstein, 1989). These physiological outputs have now become standard in simulators today.
Impact of Medical Education Reform

Since the 1990s, continued advances in technology systems and academic emphasis on active learning and deliberate practice opportunities have led to more widespread use of high fidelity simulation in medical and health care programs (Scalese et al., 2008). As described earlier, Sim One failed largely due to a perceived lack of need since the traditional apprenticeship-based model was used in training junior medical residents. Medical education reform changed the traditional apprenticeship-based model approach starting in the latter part of the 20th century, which continues today (Association of American Medical Colleges, 1999; Bradley, 2006). Prior to medical education reform, junior residents under apprenticeship-based models were expected to master their classroom knowledge in the undergraduate and beginning of their graduate medical education and then have a distinct transition to applying their clinical and communication skills by observing a senior resident. However, due to changes in medical school accreditation standards and learning objectives with the health care reform, emphasis was placed on preparing junior residents during their undergraduate education to be effective clinicians (Accreditation Committee, 2002; Bradley, 2006).

One significant problem emerged at the beginning of medical education reform in the 1980s and 1990s; knowledge information overload in undergraduate medical education curriculum was being sacrificed at the expense of trying to integrate clinical and communication skills (Bradley, 2006; Rosen, 2008). Simply put, there were not enough hours in a class to do both. As a result, a more streamlined process emerged. Programs started to revise curriculums to include clinical skills learning in the classroom
and clinical skills education facilities that could be used to apply classroom knowledge to
the simulated clinical environment (Bligh, 1995; Bradley & Bligh, 1999).

This change in medical education was certainly a dramatic shift and occurred because it was eventually recognized and accepted that young physicians who had gone through apprenticeship-based training were not properly prepared for independent professional practice. According to Carter, Aitchison, Mufti, and Scott (1990) young doctors were unable to effectively complete a urethral catheterization procedure because they had only been taught theoretical aspects rather than practical approaches of medicine. The authors argued that the traditional philosophy of “see one, do one” was ineffective at providing junior residents opportunity to develop skill competency (Carter, et al., 1990). Many other studies (Cartwright, Reynolds, Rodriguez, Breyer, Cruz, 2005; Feher, Harris, & Lant, 1992; Maguire & Rutter, 1976) echoed this concern providing examples of how junior doctors lacked the clinical competency to perform a vast array of skills. In fact, in a study by Feher, et al. (1992), the authors demonstrated that junior doctors in a hospital setting lacked the ability to accurately measure the blood pressure of a patient.

Not only were skill deficiencies recognized in young doctors, but there were also reports of high stress as a result of these individuals feeling inadequately prepared for their positions (Williams, Dale, Glucksman, & Wellesley, 1997). Williams et al. (1997) identify that psychological distress among junior doctors was as a result of the lack of communication skills training and certain clinical opportunities to practice skills.
Benefit of Simulation

This leads to the question; Why was simulation the answer? As medical education reform moved further from the apprenticeship model, it became clear that a streamlined mode of providing students a way to apply classroom knowledge into clinical practice was necessary (McManus, Richards, Winder, 1998). Simulation allows participants to practice skills in a safe, replicable environment that will be free from harm to a human patient (Gordon, Wilkerson, Shaffer, & Armstrong, 2001).

Simulation provides learners with environments of varying reality where they can transition classroom knowledge into clinical performance (Bradley, 2006). Hands-on application of skills encourages learners to acquire competency of these skills through experience (Gordon, et al., 2001). Several studies (Gordon, et al., 2001; Lasater, 2007; Mensch & Ennis, 2002) have demonstrated that a learner’s performance in a realistic simulated environment can accurately predict actual clinical performance. Lasater (2007) reported that when used as an adjunct to clinical practice, simulation supported the development of confidence, competency, and appropriate clinical judgement for nursing students in high stress hospital codes. To measure these reported simulation outcomes on clinical performance, Abrahamson, Denson, & Wolf (1969) designed a study where six analyses of clinical performance were measured after anesthesia residents completed simulation training followed by actual clinical encounters of those skills. These authors found that those residents who successfully performed endotracheal intubation training in simulation were significantly more proficient in performing this procedure on actual patients (Abrahamson, et al., 2004). Therefore, transitioning student learners from novices to experts through repeated practice opportunities in simulation translated to
improved clinical performance abilities and pose significantly less threat to patient safety (Abrahamson, et al., 2004; Rosen, 2008).

Through a literature review, Maran & Galvin (2003) summarized the advantages of using simulators in training and assessment of medical and healthcare students. The authors reported the eight most widely reported benefits of simulation are as follows;

1) risks to patients and learners are avoided, 2) undesired interference is reduced, 3) tasks/scenarios can be created to demand, 4) skills can be practiced repeatedly, 5) training can be tailored to individuals, 6) retention and accuracy are increased, 7) transfer of training from classroom to real situation is enhanced, and 8) standards against which to evaluate student performance and diagnose educational needs are enhanced. (p. 23)

**Types of Simulation**

The benefits of simulation are greatly impacted by the type of simulation that is provided. In general, simulation is measured along a fidelity continuum with low fidelity, or realism at one side and high fidelity, or very realistic on the other. Most simulators that are used today are in the low-fidelity end of the continuum because they are used in high-volume and for the learning of basic skills at undergraduate and entry-level graduate programs (Maran & Glavin, 2003). Low fidelity simulators cost dramatically less than high fidelity simulators so when there is demand for a high-volume, financial restrictions typically become the primary reason for the selection of the lower simulator type.

Low fidelity simulators are typically categorized as part-task trainers, computer-based systems, virtual reality systems, and simple mannequins (Bradley, 2006; Maran & Glavin, 2003). Low fidelity types of simulators are defined as not as realistic, however
they have a lot of use in medical and healthcare education. For example, a model of the ligaments and bones of the knee joint may be useful to visually reinforce underlying anatomy.

The most recognized low fidelity part-task trainer worldwide is the Resusci-Anne (Bradley, 2006). Asmund Laerdal, a Norwegian publisher and toy manufacturer, worked with an anesthetist in the 1960s to develop this device (Bradley, 2006; Rosen, 2008). Resusci-Anne was developed to supplement resuscitation training by providing a low-cost model that learners could practice mouth-to-mouth breathing and chest compressions (Rosen, 2008). Though technology has significantly advanced since then, due to cost this low fidelity part-task trainer continues to be the most used simulation device for resuscitation training in the world today (Bradley, 2006).

Some types of moderate to high fidelity simulators include simulated patients, simulated environments, and integrated simulators to include both instructor-driven and model-driven simulators (Kneeborne, 2003; Maran & Glavin, 2003). Simulated patients and simulated environments have become more prevalent in medical and healthcare education over the past few decades (Bradley, 2006). Simulated patients are either trained actors or peers that can present a medical history to another and mimic physical signs of an injury or illness. Simulated environments are a recreation of the space in which the activity would take place in the actual clinical setting such as a therapy clinic or operating room. The more realistic (higher fidelity) the simulated environment and patient are to that which may be found in the normal clinical environment, the more it can be expected that the learner will effectively suspend reality and become immersed in the simulation (Maran & Glavin, 2003; Rosen, 2008).
Integrated simulators are also forms of moderate to high fidelity simulation but these involve the combination of a full body mannequin with sophisticated computer hardware and software that can be manipulated to produce a variety of physiological outputs (Gordon, et al., 2001; McFetrich, 2006). Physiological parameter outputs could be physical such as respirations, pulse rates, or bowel sounds, or could be electrical such as the blood pressure and pulse oximetry readings displayed on a monitor. Also, these physiological parameter outputs within the computer software programs may be automatic or programmable by the instructor (Bradley, 2006). Programmable software allows the instructor to control physiological parameter outputs in real time from behind the computer while the student learner is acting in the simulation. For example, if a student is interacting with a mannequin and does not properly control a major bleed, the instructor could decrease the pulse and respiration rate output so that the mannequin appears to be going into shock and a cardiovascular emergency.

Both the cost and sophistication of the integrated simulators vary. At the forefront of anesthesia simulation has been the METI and Medsim and are among the highest cost but most sophisticated technology available (Bradley, 2006). Laerdal Medical has also developed a line of varying moderate to high fidelity mannequins. The SimMan is a moderate-fidelity mannequin capable of replicating many physiological responses and is used heavily in many medical and healthcare programs due to its availability at a much lower cost as compared to the METI, Medsim, and other lines of products at Laerdal Medical (Bradley, 2006). For example, according to the Laerdal Medical Products catalog (2012), the SimMan mannequin hardware (without associated software) costs
approximately $20,000 whereas the higher-fidelity SimMan 3G mannequin capable of displaying neurological and physiological symptoms costs just over $66,000.

Common direction for educators to determining the level of fidelity and type of simulation necessary needed for the learner is to consider both the educational needs of the learner and the intended output of the simulation program (Bradley, 2006). For example, low fidelity simulation with Resusci-Anne would be inappropriate for the learner who needs to develop clinical competency with the procedural skill of performing a tracheotomy.

**Emergency Cardiovascular Care Competency**

Competence is valued in athletic training. Similar to medical schools, other health care training programs, and licensing bodies, evidence of a future practitioner’s ability to competently perform skills required for that profession is important in athletic training education. According to Epstein and Hundert (2002), professional competence is the “habitual and judicious use of communication, knowledge, technical skills, clinical reasoning, emotions, values, and reflection in daily practice for the benefit of the individual and community being served” (p. 226).

Athletic training education requires its students apply knowledge and psychomotor skills in a variety of areas. Specifically, the Commission on Accreditation of Athletic Training Education (CAATE) requires competencies to be instructed and evaluated within each accredited athletic training program (CAATE, n.d.). Acute care of injuries and illnesses is one of the CAATE competency content areas for athletic training students and includes emergency cardiovascular care (ECC) competency. The ability to
respond quickly and in an effective manner to cardiovascular emergencies in athletic training settings rests on ATs and ATSs being competent in ECC procedures.

Until recently, many medical and health professions including athletic training have assumed competency attained through successful ECC certification would translate to clinical competence in cardiovascular lifesaving skills. However, recent studies offer evidence that CPR performance both in and out of the hospital setting in the United States is deficient (Ackermann, 2009; Davies & Gould, 2000). One study reported that during a code event within a hospital setting, physicians and nurses displayed poor adherence to the American Heart Association (AHA) guidelines during cardiovascular emergencies (Wayne, Didwania, Feinglass, Fudala, Barsuk, & McGaghie, 2008). Within this study conducted at the University of Chicago in an academic teaching hospital, both the depth and rate of chest compressions in ECC trained internal medicine residents and nursing staff were not of a quality to meet AHA guidelines (Wayne et al., 2008). In another study, Wik, Kramer-Johansen, Myklebust, Sorebo, Stevenson, Fellows, & Steen (2005) studied 176 cases of out-of-hospital cardiovascular arrests treated by nurses and paramedics. Chest compressions were not delivered 48% of the time and most compressions (45%-51%) without adequate depth (Wik et al., 2005). Both studies concluded the health care providers were poorly prepared, insufficiently practiced, and lacking the confidence to manage cardiovascular emergencies which occurred at a low incidence in each of these settings (Wayne et al., 2008; Wik et al., 2005).

A substantial body of research reports CPR skills learned in training decay at a rapid rate following ECC certification if not applied or regularly practiced (Davies & Gould, 2000; Madden, 2006; Perkins, Boyle, Bridgestock, Davies, Oliver, Bradburn,
Green, Davie, & Cooke, 2008; Wayne et al., 2006). Studies such as these illustrate a competency gap in skill application and subsequent retention. Positive retention gains in cardiovascular life-saving skills have been reported when medical providers are exposed to deliberate practice opportunities through the use of high fidelity simulation during or following ECC training. In a follow up study at the University of Chicago, Wayne et al. (2008) demonstrated significantly higher adherence to AHA guidelines when physicians and nurses were provided deliberate practice opportunities through high fidelity simulation as compared to traditionally trained ECC students.

There is some conflict in literature as to how long skill retention and competency are sustained after training and certification sessions. Madden (2005) defines CPR skill retention as “the capacity to perform CPR effectively at a certain point in time after CPR training” (p. 219). When determining CPR skill competency, retention plays a significant factor because if an individual acquires CPR knowledge and skill at certification but then cannot retain this ability over time, he or she will not be able to respond competently and consistently to cardiovascular emergencies (Greig, Elliot, Parboteeah, & Wilks, 1996).

There are approximately 50 psychomotor skills involved in CPR that must be properly performed to maximize a victim’s chance at survival (Flint, Billi, Kelly, Mandel, Newell, & Stapleton, 1993; Wollard, Whitfield, Smith, Colquhoun, Newcombe, Vetter, & Chamberlain, 2004). One example of a skill component in CPR is performing chest compressions. Many studies (Flint et al., 1993, Greig et al., 1996, & Wollard et al., 2004) measure CPR skill competency along a continuum from 0% to 100% for each of the core CPR skill components. In a study by Greig, Elliot, Parboteeah, and Wilks et al. (1996), the authors measured basic life support skill performance over a three-year time period
with undergraduate nursing students. The authors concluded CPR skill competency among components varied greatly over time but, overall, CPR skill retention was poor after greater than a one-year time period following instruction without recertification (Greig et al., 1996).

Boet et al. (2011) and other similar studies (Ackermann, 2009; Wayne et al., 2008) reported successful cardiovascular arrest team response for at least one year following high fidelity simulation. Through a randomized experimental study, Boet et al. (2011) assigned groups to either a 6-month or 12-month group. Approximately 40 anesthesia residents within each group completed a high fidelity simulation that involved complex airway management in cardiovascular arrest. The skills of all subjects were measured using a global-rating scale, procedural time, and competency checklist pre-simulation and immediately post-simulation. Then, either 6 months or 12 months later depending on group assignment, all the skills of all subjects were again measured and no significant differences between the groups was found; both improved from pretest and had retained those skill improvements posttest over time (Boet et al., 2011).

However, in a study on nursing students’ acquisition and retention of CPR knowledge and skills, Madden (2005) found there was a significant deterioration in CPR cognitive knowledge and skill competency in 10 weeks following traditional low fidelity CPR training. Other studies (Inwood, 1996; Moser & Coleman, 1992) echoed these findings suggesting that in as little as two weeks following traditional CPR training, there is deterioration in both cognitive knowledge and skill ability. It is very important to note that while there was a significant deterioration in CPR performance, there was not a total loss of skills learned in training (Inwood, 1996; Madden, 2005). In fact, CPR
performance remained significantly improved for a time period of one year from pre-training to post-training even after the deterioration of skills in the weeks to follow training.

Factors such as clinical incidence, self-efficacy, motivation, and teaching practices have all been identified as influencing long-term competence in CPR-related skills (Ericsson, 2004). Teaching practices include both the type of instruction and what fidelity of mannequins and other materials that are used for training. The majority of basic life support CPR courses utilize low fidelity part-task trainers such as the plastic head/foam body Resusci-Anne device (Moser & Coleman, 1992; Rosen, 2008). These part-task trainers are the lowest cost option and provide opportunities to train significantly more individuals in one class session than alternative practice options such as utilizing a full-body high fidelity integrated simulator.

However, a disadvantage in utilizing part-task trainers in CPR training is the learner will not have the same opportunities to gain feedback on skill performance as they might with a higher fidelity option. For example, one skill competency component of CPR includes providing correct ventilation volume. A learner may deliver a ventilation to a low fidelity device such as the Resusci-Anne but will not be able to measure the amount of air that successfully entered the lungs. Computer software applications within high fidelity equipment allow the instructor to measure and record the specific amount of volume that enters the mannequin’s lungs when a breath is delivered. Then, the instructor can give this feedback to the student learner and which allows them to make adjustments if necessary as they are gaining practice and developing competency.
Ventilation volume consistently is reported as the poorest performed skill component of CPR (Greig et al., 1996; Devlin, 1999; Madden, 2005). Madden (2005) measured competency with this CPR component immediately following nursing students’ training with low fidelity part-task trainers and found that no students passed the criteria for skill competency and were unable to deliver the proper amount of air during ventilations. Devlin (1999) suggests that the type of instruction and practice that the participant experienced likely had a significant effect in their lack of ability to perform this skill claiming they were “insufficiently trained and poorly practiced” (p. 203).

The second lowest ranked CPR skill component is adequate depth of chest compression (Greig et al., 1996; Devlin, 1999; Madden, 2005). Again, the depth of chest compression is not measurable with a low fidelity part-task trainer so a lack of feedback on improper technique is likely contributing to poor performance with this skill component. In addition to this factor, Devlin (1999) also identifies critical thinking and self-efficacy as factors to influence a subject’s ability to correctly perform chest compressions.

Devlin explains that most traditional CPR training relies on memorization of treatment algorithms; 30 compressions, followed by 2 breaths, repeat 5 times. However, those responding to cardiovascular emergencies do not only have to perform the skills correctly in a certain order, but they also must be able to modify their performance and treatment approaches in response to the patient’s condition (Devlin, 1999). For example, if the respondent is providing rescue breathing and the victim deteriorates further and loses their pulse, the respondent should be prompted to change their treatment to include both ventilations and chest compressions. Devlin (1999) suggests a lack of training where
individuals are put into situations to make critical thinking decisions as well as improve self-efficacy or confidence contributes to poor CPR skill performance.

**Self-Efficacy Theoretical Framework**

Murphy and Kraft (1993) found that self-efficacy mediates knowledge and performance. Bandura (1977) described self-efficacy theory as an individual’s belief that they have the capabilities to perform actions necessary to achieve a given effect. Despite possessing appropriate knowledge and skill to perform in various daily scenarios, individuals frequently do not behave optimally. The degree to which individuals judge their capabilities or perceive their self-efficacy can dramatically affect their behavior (Bandura & Cervone, 1986). The tendency for individuals is to participate in tasks within their perceived self-efficacy range and avoid those tasked that are perceived as beyond the individual’s ability. For example, within athletic training, if the AT or ATS has a self-perceived inadequacy in performing CPR skills, they may either hesitate or not apply the knowledge and skills to intervene on behalf of the patient. Since response time to cardiovascular emergencies is crucial to successful outcomes, this could affect patient outcomes.

Bandura and Cervone (1986) explain that perceived self-efficacy enables individuals to apply a degree of control over their feelings, thoughts, motivation, and actions. This provides a reference mechanism for perceiving, regulating, and evaluating behaviors from interaction with environmental influences (Pajares, 1997). In its simplistic form, perceived self-efficacy serves a self-regulatory function. Based on the individual’s perceived self-efficacy, cognitive processes and behaviors are influenced which subsequently affects his or her ability to alter their environment (Pajares, 1997).
According to Bandura and Cervone (1986), self-efficacy is concerned with the level an individual feels capable of producing a specific desired outcome or ability to perform a particular skill. Therefore, an athletic training student’s judgment of perceived self-efficacy is not necessarily connected to the knowledge and skills they have acquired, but instead is based on their perception of confidence in applying the skill to a particular scenario.

One important distinction to note within the theoretical framework is the difference between efficiency expectations and outcome expectations related to an individual’s perceived self-efficacy. Bandura (1977) explains that efficiency expectation are an estimate of how confident an individual is that they successfully execute a certain behavior to produce a certain outcome. An example of this would be if an athletic training student feels confident they could successfully perform the skill of chest compressions on a cardiac victim. On the other hand, outcome expectations are an estimate of how confidence an individual is that their behavior will lead to a certain outcome (Bandura, 1977). Using the same example of a cardiac victim, outcome expectations would be the confidence that an athletic training student may have that the chest compressions they perform would actually lead to saving the victim’s life and/or adequately circulating their blood. It is important to note the distinction because if an individual believes that a certain action will produce certain results (outcome expectation), but has doubts as to whether they can perform that behavior (efficiency expectation), they may hesitate which would impact both areas of expectation regarding the current situation.
There are different expectation levels within efficiency expectations that contribute to perception of self-efficacy (Bandura, 1977). At the initial level, an individual’s perception of efficiency expectation is influenced by the convictions of personal mastery with task associated with achieving a certain outcome. According to Bandura (1977), the strength of the individual’s conviction in these tasks will affect both if they initiate and action or behavior as well as if they persist with that behavior in the face of adversity or challenges that arise. This initial task-focused level of efficiency expectation directly impacts the higher level self-regulatory component of self-efficacy. Bandura (1977) explains task competence will directly impact coping efforts once a behavior is initiated. If an individual has high efficiency expectations related to certain tasks within a behavior, they will be more likely to expend effort for a greater duration of time and will persist in the face of obstacles and adverse experiences. Therefore, the stronger the task component efficiency, the more likely the individual will have a higher self-regulatory evaluation and will retain the behavior (Bandura, 1977).

A strong level of perceived self-efficacy in one area, does not necessarily translate into another area or domain. Bandura (1977) states “self-efficacy beliefs should be measured in terms of particularized judgments of capability that vary across realms of activity, different levels of task demands within a given domain, and under different situational circumstances.” (p. 6) In a study of health promotion and practice, Maibach and Murphy (1995) concluded individuals may commonly self-judge themselves to be competent in one area and lack perceived self-efficacy in another area. For instance, an athletic training student may feel very competent to apply a splint to a fracture, but may not feel that same competence in managing events that occur with lower incidence such
as cardiovascular emergencies. Since there are many different components that go into managing an emergency situation, it can be concluded that there is a difference between possessing knowledge and skills within this area, and having the confidence to actually use them. Bandura and Cervone (1986) explain that successful or competent functioning occurs when individuals possess appropriate skills and also perceive they have the ability to use these skills effectively.

There are two types of expectations related to self-efficacy; outcome expectations and efficiency expectations. According to Opacic (2003), outcome expectations can be defined as an estimate of how one behavior will lead to certain outcomes. The outcome expectation can affect the initial motivation an individual has for a task based on how much they want to achieve the projected outcome (Gee, 2006). Efficiency expectations are defined as how confident an individual is that they are capable of performing the necessary behavior to achieve a certain desired outcome (Bandura & Cervone, 1986). The efficiency expectation can affect the amount of exertion and perseverance that an individual puts forth when an adverse reaction occurs. An example of this can be found in examining the confidence levels of healthcare providers in performing CPR on pediatric patients. Through a series of three case reports, Maibach et al. (1996) identified that clinicians were less likely to initiate and sustain ECC skills on pediatric patients when they felt they did not have adequate experience with this population. One case found that a pediatric internal medicine physician performed emergency management skills on a pediatric patient for just 10 minutes before pronouncing time of death, which is significantly less time than expected. It was concluded that when clinicians lack the self-
confidence to perform a desired set of skills, they are less likely to exert the effort and persevere in providing CPR to these patients (Maibach, et al., 1996).

Bandura (1977) explains that if individuals have a high efficiency expectation, even in the face of adversity, they will likely judge themselves as more confident to perform certain skills and therefore are more likely to persist to reach a certain outcome. Therefore, outcome expectations are dependent upon efficiency expectations (Gee, 2006).

Before moving forward with a review and application of self-efficacy theory it is important to note that there is some criticism to Bandura’s model. The most significant argument is whether a causal relationship exists between self-efficacy and behavior that Bandura suggests. Critics believe that self-efficacy ratings and behavior may not illustrate a causal relationship but instead, are correlated and that environmental variables may account for the manipulation of those relationships (Biglan, 1987).

Similarly, Moore (1984) explains that the relationship between self-efficacy and the behavior is inherently correlational because both responses are of the same variable. Any change in environment or procedure that affects an individual’s self-efficacy is also applied to the same environment that affects behavior. Therefore, Moore (1984) explains it is not that the change in self-efficacy causes a change in behavior. Instead, it is argued that both self-efficacy and behavior are manipulated together by the environment and therefore correlated.

Considerable evidence offering support of the causal relationship between self-efficacy and subsequent behaviors exists, but critics question the consistency and strength of these findings (Biglan, 1987). For example, Bandura and Adams (1977) show self-efficacy ratings predict post-treatment behaviors of phobics regardless of the treatment
procedures (environment) that was used. Kirsch (1980) points out that the method used to
assess congruence between self-efficacy and post-treatment behaviors may have been
flawed. The researchers utilized a Guttman scale to assess the degree to which individuals
complied with post-treatment plans and their level of self-efficacy with their plan
(Bandura & Adams, 1977). Guttman scales typically present items in a Likert format or
where the respondents are asked to agree or disagree with the item. Kirsch (1980) points
out that in Guttman scales, subjects typically will have one point where they go from
endorsing (strongly agreeing with) to not completing (or strongly disagreeing with) the
items. For example, if there were a 10-question scale and an individual answered ‘agree’
with nine items but on item #10, disagreed, they would have a .90 congruence score.
Bandura and Adams (1977) yielded a congruence score of .80 in their study on phobics
behavior. Critics argue that due to the fact that some of the responses on the scale could
have been in direct contrast (strongly disagree) with the findings but they still will have a
high congruence score, there are reasons to cast doubt on the methodology used to
measure the self-efficacy phenomenon (Biglan, 1987).

Through there has been a good deal of criticism in earlier theoretical analysis of
Bandura’s self-efficacy theory, overarching support continues to drive new research
forward. There is widespread acceptance of the causal relationship of self-efficacy to
subsequent behavior in research and application across diverse disciplines (Bandura &

Sources Contributing to Self-Efficacy

According to Bandura (1977), there are four sources of information that
contribute to the self-knowledge of an individual which affects personal self-efficacy:
performance attainment, vicarious experiences, verbal persuasion, and personal physiological status. From a description of self-efficacy theory, Bandura (1977) reveals the most influential source of information is performance attainment. When an individual accumulates consistent successes or failures in a particular task, it will respectively increase or decreases perceived self-efficacy. Performance attainment is achieved by an individual actually executing a skill. An example of this would be an athletic training student who responds to a cardiac victim by actually approaching and initiating CPR beginning with chest compressions and ventilations.

A vicarious experience is obtained when an individual observes a similar person participate in a task. If in that vicarious experience, the participating individual was successful, the observer may believe they are capable of achieving the same result. Bandura (1977) explains that vicarious experiences are less influential than performance attainment, but more commonly contributors to perceived self-efficacy because they occur more frequently. An example of a vicarious experience would be if an athletic training student observed his or her peer perform chest compressions on a victim. The individual would not have gained experience by actually performing the skills, but instead would gain experiences through watching the performance of the other student.

The next source of information that contributes to self-knowledge is verbal persuasion. In this source, an outside source is trying to convince an individual that they have the necessary skills to achieve a desired outcome (Bandura, 1977). An example for this would be if an ECC instructor taught students CPR skills but did not give them an opportunity to practice. Instead, the instructor may verbally try to convince the student that since they understood the skills, they now will have the ability to successfully save a
life. The students’ perceived self-efficacy of using CPR skills would be entirely dependent on verbal persuasion of the instructor and would not include any actual practice or observation of the skills being performed. According to Bandura (1977), verbal persuasion is less influential than the previously discussed sources of information. Therefore, in the example provided, the verbal persuasion of the ECC instructor would have less influence on the perceived self-efficacy of students compared to performance attainment or vicarious experiences.

The final, and least influential source of information is personal psychological status. Gee (2006) explains that emotional reactions, stress, or tension can all be interpreted by an individual to affect physical ability. Therefore, if an individual is in a negative emotional state, they may judge their capability to successfully attain a certain outcome as less than an individual who is in a positive emotional state. An example of this would be if an athletic training student was particularly stressed about a poor performance on a classroom exam and worried about his or her overall success in the course. This student may judge his or her ability to attain a positive outcome to a cardiac emergency at their clinical site more negatively than an athletic training student who has a more positive psychological status.

**Application of Self-Efficacy Theory to Performance Enhancement**

Self-efficacy is a changeable attribute that may be enhanced through training (Bandura & Cervone, 1986; McConville & Lane, 2006). Enhancing ATSs’ self-efficacy through high fidelity simulation training may enhance their clinical performance during cardiovascular emergencies. During high fidelity simulation, performance attainments may occur as a result of personal experience by participating in the scenario. In addition,
many simulation designs include peer student observers within each scenario. Students in the observer role are instructed to not intervene in the simulation and are relegated to strict visualization of the scenario. Vicarious experiences are obtained by students in the observer role as they watch their peers participate in a simulated experience.

In addition to vicarious experiences obtained by observing a simulation, a typical high fidelity simulation will offer additional opportunities for learning. Best practice recommendations for the design of high fidelity simulations include actual hands on participation or observation of a scenario with the mannequin followed immediately by an instructor-led debriefing session (Scherer, Bruce, Graves, & Erdley, 2003). Simulation debriefing is a guided reflection on what occurred during the simulation scenario. It may include a discussion of the things that went well, the things that did not go well, rational for why the student made a certain decision, and what they may change in the future based on what they experienced. The debriefing discussion may also be supplemented with a video of the actual simulation where participants and observers can watch on screen what occurred and discuss specific actions.

Overall, the simulation debriefing has the goal of developing knowledge, skills, and rational for clinical skills and appropriate action (Neill & Wotton, 2011). Several studies suggest debriefing is equally if not more beneficial to learning than the actual simulation event (Gordon, et al., 2011; Neill & Wotton, 2011). Related to self-efficacy theory, the debriefing also gives all participants an additional opportunity to analyze and learn from their actions through either a reflective discussion or analysis through viewing actions in a video.
Self-efficacy Related to Clinical Performance

Self-efficacy theory provides the theoretical framework for the exploration of the use of high fidelity simulation on the confidence of athletic training students in managing cardiovascular emergencies. The concept that increased self-efficacy improves clinical performance has been previously studied in a variety of medical and health care disciplines including anesthesiology (Nishisaki, Keren, & Nadkarni, 2007), internal medicine (Wayne et al., 2006), pediatrics (Maibach, Schieber, & Carroll, 1996), nursing (Blum et al., 2010; Gee, 2006; Wagner et al., 2009), physician assistant (Opacic, 2003), psychology (Stajkovic & Luthans, 1998), and dietetics (Lorenz, Gregory, & Davis, 2000).

A provider’s confidence in his or her ability to perform a certain skill is vital to that provider taking action. According to Maibach, et al. (1996), pediatricians with adequate knowledge and skills in cardiovascular resuscitation may be reluctant to take appropriate actions unless they are confident in their abilities. Maibach et al. (1996) reviewed three case reports to determine the effects perceived self-efficacy had on clinical performance during pediatric cardiovascular resuscitation. They concluded that performance-based self-efficacy can be distinguished from both knowledge and skills necessary to perform in a cardiovascular emergency (Maibach et al., 1996). In short, a provider may fail to take clinical action or may operate with poor clinical performance if they have a low self-efficacy even when they may have the knowledge and skill to perform the related clinical skills.

True positive patient outcomes have been reported when health care providers are able to participate in deliberate practice opportunities to increase their clinical capabilities.
and improve their confidence. In a study by Lorenz, et al. (2000), 119 registered dietitians participated in a pretest, posttest study design that examined the self-efficacy scores of participants before and after completing a training program in diabetes management. Those self-efficacy scores were then correlated with an assessment of the clinician’s abilities to successfully manage diabetic patients in clinical practice following training. Results demonstrated a statistically significant relationship between increased self-efficacy and self-reported successful clinical outcomes (Lorenz et al., 2000).

Evidence demonstrating relationships between self-efficacy and clinical performance have prompted studies investigating the predictive relationship self-efficacy has on subsequent clinical performance. Results of a multi-centered study that included 300 physician assistant students over 14 accredited programs, revealed that self-efficacy scores were a significant predictor of a student’s clinical performance (Opacic, 2003). In another study, Wayne et al. (2006) conducted a follow up survey with 40 internal medicine residents following ECC simulation-based training programs that provided participants with deliberate practice opportunities to respond to cardiovascular emergencies. It was reported that participants who had higher self-reported feelings of confidence following the simulation were also more likely to adhere to ECC guidelines in response to clinical cardiovascular emergencies (Wayne et al., 2006).

Application to Leadership

The Ethical Lens Inventory is a personal evaluation tool that can be useful in helping individuals identify personal values and understand how the way in which individuals prioritize those values may influence choices (EthicsGame, 2014). From the Ethical Lens Inventory (ELI) taken on 10/28/14, I identified my leadership lens as in the
rights and responsibility lens with core values in autonomy and rationality. This is important to understand as I reviewed relevant literature about my topic. The rights and responsibility lens means that I use a rational approach determine how to proceed (EthicsGame, 2014). This is a very data driven lens and I recognized that I feel most connected to this as I explore quantitative literature with significant findings.

Transformational leadership theory strongly related to my identified ethical lens as it emphasizes rational, cognitive processes (Leban & Zulauf, 2004). When comparing different leadership styles, transformational seemed most appropriate to take with my topic as with many in the medical and health care disciplines. Transformational leadership has been linked to high levels of effort (Leban & Zulauf, 2004), confidence (Podsakoff, MacKenzie, Moorman, & Fetter, 1990) and exceptional levels of performance (Yammarino & Bass, 1990). These variables are all very relevant to outcomes in medical and health care training because the way in which these future health care professionals perform will have an impact on their patients. For instance, the inability to perform CPR skills or a low self-efficacy in emergency cardiovascular care could result in the death or permanent disability of a victim. This made the integration of transformational leadership theory especially important to consider pertaining to literature about my topic.

Leadership in Athletic Training Education

As an educator in athletic training, I have the responsibility of teaching someone so they can understand and act in order to serve others. The Commission on Accreditation of Athletic Training Education (CAATE) has an accredited competency-based program that serves to standardize athletic training education and improve
consistency among programs (CAATE, n.d.). Instructors within clinical and classroom settings are expected to integrate a variety of competencies related to athletic training so that a student within a CAATE accredited program has the opportunity to develop necessary skills to have successful performance as a Certified Athletic Trainer (Mensch & Ennis, 2002).

While specific competencies are outlined for CAATE accredited athletic training education programs, the methods of instruction and practice of these associated clinical skills is generally left to the discretion of the program. A review of teaching pedagogic constructs finds that one component of good educational practices includes the integration of achievement motivation constructs into student learning (Mensch & Ennis, 2002). Applied to leadership theory, this means if an instructor can motivate students by providing an understanding that the skills they are learning are vital to their future success as healthcare providers, it may have a positive result.

There is also a focus in medical and healthcare education programs and in professional practice settings to guide practice with evidence-based practice (Steves & Hootman, 2004). Within the clinical setting, Sackett, Rosenberg, Gray, Haynes, & Richardson (1996) define evidence-based practice as “the integration of the best research evidence with clinical expertise and patient values to make clinical decisions” (p. 83). Research evidence found in the literature may prove or disprove the effectiveness of a particular treatment that a clinician is performing and should lead to a more effective method of care (Steves & Hootman, 2004). As an athletic training educator, I should use this same approach to developing my methods of instruction.
Several studies relating to emergency cardiovascular care in professional practice of physicians and health care professionals reported that providers were poorly prepared and lacked the confidence necessary to manage these emergencies following traditional CPR training. This is of great concern to me as an educator who is providing ECC certification to future health care providers and tells me that the current method of instruction is insufficient.

These findings that I explored throughout the literature review took my topic from an area of personal interest to an area of necessity. As an educator in athletic training education, I feel it is my responsibly to provide students with experiences and knowledge so that they may be prepared to act, perform, and practice within their scope of medicine. If I apply the literature to the current way in which athletic training students are taught and practice emergency cardiovascular care skills, it is clear that their training is insufficient. The current study adds to the literature on methods of ECC training and can provide other athletic training educators with evidence to support a different method of teaching and training that could lead to more positive outcomes.

**Summary**

The aim of this study was to design an evidence-based solution to provide deliberate practice opportunities to athletic training students that would result in increased perceived self-efficacy related to emergency cardiovascular care. A key component of any evidence-based approach is to first provide a deep exploration of published literature and theoretical views surrounding the identified problem. The previous section identifies high fidelity simulation as a well-validated educational
technology that is appropriate to select for this study as a method to providing deliberate practice opportunities related to emergency cardiovascular care.

Additionally, a review of self-efficacy theory provides the framework for understanding why this variable is important and how it applies to a variety of medical and health disciplines. Understanding the dependent relationship that has been established between perceived self-efficacy and clinical competency allows for the use of this platform as an appropriate evidence-based approach for this study. Integrating the identification of a real-world problem within the professional practice and education of athletic training with the related literature leads to this design of the current study with the goal of using evidence to provide a thoughtful solution to the identified problem.
CHAPTER THREE: PROJECT METHODOLOGY

Introduction

The competent athletic trainer must possess a variety of knowledge, skills, and clinical abilities. One important clinical ability is to be able to identify and properly intervene during rarely occurring, high risk events such as cardiovascular emergencies. Traditionally, athletic training students obtain the related CPR knowledge and skills from lecture and one-time, low fidelity part-task trainers. A review of literature has demonstrated that it is unlikely that this method of instruction will provide students with the competence and clinical self-efficacy necessary to be successfully involved in the management of a patient during a cardiovascular emergency.

An approach to improving skill competency is to enhance a student’s self-efficacy. High fidelity simulation provides students with a safe and realistic environment to gain experience and self-efficacy as they apply clinical skills to simulated encounters.

Purpose of the Study

Given that levels of perceived self-efficacy are malleable and high fidelity simulation can provide many positive outcomes, the purpose of this quantitative quasi experimental study was to determine whether participation in a high fidelity simulated cardiovascular emergency scenario using the Laerdal® SimMan increased undergraduate athletic training students’ self-efficacy scores in a university simulation center in the United States.
Aim of the Study

The aim of this study was to design an evidence-based solution to provide deliberate practice opportunities to athletic training students that would result in increased perceived self-efficacy relating to emergency cardiovascular care.

Central Research Question

The central question for this study was: What is the difference in self-efficacy scores of athletic training students prior to and following participation in or observation of a high fidelity cardiovascular emergency scenario utilizing the Laerdal® SimMan?

Hypotheses

Specifically related to the central research question in this quantitative quasi experimental study design, the following three hypotheses were investigated;

Hypothesis 1: Participation in or observation of a high fidelity cardiovascular emergency simulation will increase self-efficacy among all participants and observers.

Hypothesis 2: Those who participate in a high fidelity cardiovascular emergency simulation will have higher self-efficacy scores than those who observe the simulation.

Hypothesis 3: High fidelity simulation effects on self-efficacy ratings will persist at 6 months after participation in or observation of a high fidelity cardiovascular emergency simulation.

Research Design

The study used a pretest-posttest repeated measures quantitative quasi experimental design to evaluate the effects of a high fidelity cardiovascular emergency simulation on athletic training students’ self-efficacy scores. Utilization of random
assignment within the quasi experimental design provided a control for variability among participants.

The Emergency Cardiovascular Care Appraisal Inventory (ECCAI) survey instrument was developed for this dissertation in practice with the purpose of measuring perceived self-efficacy scores related to actions occurring in a cardiovascular emergency. Perceived self-efficacy scores of athletic training students was the dependent variable in this study and the two-level independent variable was high fidelity simulation (participator v. observer). The independent variable in this study is the mode of involvement in high fidelity simulation; participator or observer. The dependent variable is the self-efficacy scores gathered through the ECCAI survey.

**Participants/Data Sources**

The study used a convenience sample of 46 undergraduate athletic training students recruited from a Commission on Accreditation of Athletic Training Education (CAATE)-accredited university program in the Midwest. The undergraduate professional athletic training program was eight semesters in length. The curriculum was designed to provide didactic and clinical courses combined with placement in clinical experience settings beginning in semester three and continuing consecutively over the remaining five semesters in the program. High fidelity simulation was introduced in a limited fashion to include emergency cardiovascular scenarios only.

It was important to use undergraduate athletic training students because they were not yet certified athletic trainers and therefore the only exposure they had to the clinical setting was through their clinical experiences which were arranged by the university. Using only athletic training students from one university allowed me to have control over
making assumptions that the students were receiving similar clinical experiences because they were all placed at the same sites.

**Participant Recruitment**

During the time of the study, I worked as a faculty member from the Sports Medicine and Athletic Training department at the university where the study was conducted and therefore had access to the athletic training students for participation in the study. I wanted to utilize students across two different cohort or grade levels so, for that reason, I did not recruit participants as part of a specific course or class requirement.

Following IRB approval, I contacted the two cohorts by communicating with them face-to-face. I saw students across both cohorts on a weekly basis through courses where I was their instructor. I presented the opportunity to participate in my study to the students in the second and third level clinical practicum classes and informed them that participation was optional and is not affiliated with any class assignment.

I relied on undergraduate students volunteering their time outside of a graded class assignment, and as such, I was able to arrange hours to count towards an Interprofessional Education (IPE) requirement. In semesters three through eight of the professional athletic training program, students gain 15 IPE hours in addition to their regular clinical assignments. IPE hours are designed to provide students with unique experiences outside of traditional athletic training settings where they are exposed to different disciplines and/or different techniques.

**Description of Participants**

The convenience sample included two classes of athletic training students, one at the second year and one at the third year level. Almost half of the study, (47.8%),
included second year students \((n = 22)\) who had completed three semesters in the professional athletic training program. 52.2\% of the study included third year athletic training students \((n = 24)\) who had completed five semesters in the professional athletic training program. The majority of participants were female \((65.2\%, n = 30)\). Age of the participants ranged from 19 to 31 years with the majority of participants 20 years of age \((34.8\%, n = 16)\) or 21 years of age \((41.3\%, n = 19)\). The majority of participants had between one and three years of CPR certification \((71.8\%, n = 33)\) with 21.7\% \((n = 10)\) participants holding additional certifications as a lifeguard or emergency medical technician. The majority of participants \((95.7\%, n = 4)\) had not ever been part of a real-life cardiovascular emergency experience where they had to perform CPR skills such as chest compressions or ventilations. Finally, approximately half the participants \((52.2\%, n = 24)\) had never participated in a high fidelity simulation prior to this experience while the remaining \((n = 22)\) participants reported participating in one high fidelity simulation prior to the current experience (see Table 1). The students who had participated previously in a high fidelity simulation had done so as part of a previous clinical practicum course requirement.
Table 1

Demographic Descriptions of Athletic Training Students (N = 46)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level in Program</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Second year</td>
<td>22</td>
<td>47.8</td>
</tr>
<tr>
<td>Third year</td>
<td>24</td>
<td>52.2</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>16</td>
<td>34.8</td>
</tr>
<tr>
<td>Female</td>
<td>30</td>
<td>65.2</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>2</td>
<td>4.3</td>
</tr>
<tr>
<td>20</td>
<td>16</td>
<td>34.8</td>
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<td>23</td>
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<tr>
<td>25</td>
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<td>4.3</td>
</tr>
<tr>
<td>31</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td>Years CPR Certified</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>11</td>
<td>23.9</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td>19.6</td>
</tr>
<tr>
<td>3</td>
<td>13</td>
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<td>Additional Certifications</td>
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</tr>
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</tr>
<tr>
<td>No</td>
<td>36</td>
<td>78.3</td>
</tr>
<tr>
<td>Real Life Encounter</td>
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<td></td>
</tr>
<tr>
<td>Yes</td>
<td>2</td>
<td>4.3</td>
</tr>
<tr>
<td>No</td>
<td>44</td>
<td>95.7</td>
</tr>
<tr>
<td>Previous Participation in Sim</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>22</td>
<td>47.8</td>
</tr>
<tr>
<td>No</td>
<td>24</td>
<td>52.2</td>
</tr>
</tbody>
</table>
Instruments for Data Collection

Perceived self-efficacy in performing emergency cardiovascular care was measured using the Emergency Cardiovascular Care Appraisal Inventory (ECCAI) survey instrument. The instrument contains 20 questions, each measured on an 11-point Likert scale (Appendix A). The total mean scores for the instrument range from 0 to 10. The same instrument was used for both pretest and posttest measurements. After searching current literature, I found that there was not a survey that measured self-efficacy specifically related to emergency cardiovascular care. Therefore, I used Bandura’s (2006) published guide for constructing self-efficacy scales in order to develop the ECCAI survey instrument. All 20 questions focus on task components that are required to respond to an emergency cardiovascular event. Since these initial level task components lend strength to an individual’s self-regulatory measure of efficiency expectation in face of challenge, I wanted to first use the current study to establish evidence that athletic training students believe they have can perform the tasks necessary to successfully execute CPR on a victim. Higher level self-regulatory efficiency expectations, or a measure of if athletic training students have the self-efficacy to continue the behavior in face of challenges or adversity (such as breaking a rib or delay in EMS response), can be evaluated in future studies once the initial task efficiency level of self-efficacy has been established.

Following the construction of this 20-question survey, I conducted both a face and content validity test on the instrument. Questions were examined for face validity by a panel of experts ($n = 6$) who all had greater than 10 years of teaching experience in athletic training education and were all emergency cardiac care instructors for more than
10 years. Several slight modifications were made to the survey instrument based on their feedback.

Using a 6-point Likert scale ranging from 0 to 5, the same panel of experts \( n = 6 \) examined the questions for content validity responding to how useful and appropriate each question rated. Essential scores were identified as 4 and 5 and coded as 1 in the data analysis. Non-essential scores from the experts (0, 1, 2, 3) were coded as a 0 in the data analysis. Content validity index was calculated at .93. Using Lawshe’s (1975) CVI table with a level of significance set to \( p \)-value .05, the content validity was recorded as CV(6) = .800 \( p < .05 \) thus it can be judged as having excellent content validity.

Reliability of the ECCAI survey instrument was determined by running a Cronbach’s alpha on a sample of athletic training alumni \( n = 27 \) to determine the internal consistency or average correlation of the items in the survey instrument. Tavakol and Dennick (2011) state acceptable values of alpha range from .70 to .95. Anything lower than .70 is likely interpreted as poor interrelatedness between items and an alpha value above .95 is a sign of redundancy (Tavakol & Dennick, 2011). Overarching Cronbach’s alpha for the whole instrument was calculated at the value of .95 which suggests the instrument is highly reliable.

Questions on the ECCAI survey were an assessment of the degree of confidence an individual felt with skills related to ECC. Examples of questions are ‘Recognize the factors associated with cardiovascular emergencies’ and ‘Complete an initial assessment within 15 seconds of arriving on the scene of an emergency’. The complete ECCAI survey instrument may be viewed in Appendix A.
Data Collection Procedures

Permission

Permission for the study was obtained from two Institutional Review Boards (IRBs). The principle investigator was a student at one university but conducting the research using the simulation lab and participants at another university therefore the proposed study was submitted to both IRBs. Notices of IRB approval are provided in Appendices B and C. All data was collected by the principal investigator.

Procedural Process

Participants were approached as a group face-to-face by the investigator and asked for individual voluntary participation in this study. They were provided with a sign-up sheet to write their name for a particular time they were available and interested in participating in the study. Each time listed had four available spots. The sign-up sheet served two purposes. First, it self-selected students into small groups of four based on the time they chose to sign up for the single data collection session. Second, numbers 1-46 were placed next to the names. These numbers became the participant’s identifying number in the study therefore blinding the participant’s names or identifying information in the data. This quasi-experimental design limited true random assignment as participants initially self-selected into groups based upon their schedule and the time they choose to sign up to participate in the study.

On the day of the simulation, participants in groups of four reported to the university simulation center based on the time they signed up for. Participants were introduced to the study, given a chance to ask questions, and sign the consent (Appendix D).
Participants first were asked to complete the demographic intake form (Appendix E). Then participants were given the ECCAI survey to complete which served as the pretest self-efficacy score. The ECCAI surveys were distributed by placing four surveys in the middle of the table. Two of the surveys were printed on white paper and the other two surveys were printed on light grey paper but the content was identical. The participants were instructed to take a survey and complete it. Whatever color of survey the participant took placed them randomly into a group; participant or control. Those that selected the white paper were placed in the participation group and those that selected the grey paper were placed into the observation group. The ID numbers of those in the participation and observation groups were recorded on the top of all surveys and demographic forms so the participant or control group factor could be analyzed in the posttest surveys.

Next, based on their group assignment, they either participated in or observed a high fidelity emergency cardiovascular simulation using the Laerdal® SimMan. Two cardiovascular emergency scenarios were utilized in this study. A description of the scenarios is provided in Appendix F. Investigator alternated use of the scenarios equally throughout the groups. The simulation scenario began with the two observers in the room with the mannequin and the two participants outside of the room. The observers were given specific instructions by the principal investigator that they were to not intervene in any way in the scenario and could not respond if the participants asked them to physically do something. While standing outside of the simulation room and not able to view the mannequin (victim), the two participants were read an opening sentence describing the
background of the scenario. Following the background statement, the two participants were then told to proceed into the simulation room to respond to the victim.

When the participants entered the room with the mannequin (victim), the principal investigator took position in an adjacent control room. From the control room the investigator manipulated physiological responses of the mannequin from the computer and observed the participants’ actions through audio and video. The scenarios each took between 10-15 minutes to complete. Included in each of the scenarios was a cardiovascular emergency where the victim became pulseless and lifeless which required a response of CPR from the participant(s). A full description of the scenarios and response sequence is provided in Appendix F.

Following the conclusion of the simulation scenario, the group of four participated in an instructor-led debriefing session which lasted 15-20 minutes. The instructor-led debriefing included a discussion of what the participants did well, why they made the treatment decisions they performed, what went poorly, and what may lead to better outcomes in similar future clinical encounters. An important goal of the debrief is to provide students with an objective reality based on the actions they performed in a honest but supportive manner. For example, the depth of compressions that the participant demonstrated as compared to the required depth to adequately circulate blood in a victim may be discussed. Both the participants and observers participated in the debriefing discussion. Immediately following the debriefing, all participants (participation and observation group) completed the ECCAI survey which served as the first posttest self-efficacy score in this repeated measures study design. The participants were then thanked for their time and dismissed from the simulation center.
Six months following completion of the simulation scenario, all participants (participation and observation group) again completed the ECCAI survey which served as the second posttest self-efficacy score over time. In highly critical events such as emergency cardiovascular care, emotions and stress can influence actions and reactions (Scherer, et al., 2003). It takes time to assimilate the actions and learning of this type of experience (Blum, Borglund, & Parcells, 2010). Previous literature identifies CPR related learning outcomes to be maintained for up to one year following high fidelity simulation. Therefore, the researcher believes the post-test measurement of self-efficacy administered six months after the simulation would provide more accurate insight into the student’s true assessment of self-efficacy over time.

Following completion of this second posttest survey, participants were thanked for their time and told their participation in the study was complete.

Funding

In December 2015, I submitted a research grant application to the Mid-America Athletic Trainers’ Association (MAATA) Research and Education Committee to fund my study (Appendix G). This grant was awarded in March, 2016. MAATA grants are designed to assist athletic trainers in conducting quality minor research and instructional development in the area of athletic training.

I requested $1000 from the MAATA Research and Education Committee to purchase an AED training unit ($382.46) along with supplemental AED equipment to include AED replacement pads ($139.07 each), CPR barrier devices ($12.65 each) and an AED soft case ($96.04). The cotton t-shirts (4-pack $15.88) and jerseys (12-pack $14.99) were requested to dress the mannequin so that the fidelity (or realism) of the simulation
scenario was increased. As part of simulation, students were required to cut the shirt/jersey off of the victim in order to expose the chest to correctly place the AED unit.

**Ethical Considerations and Quality Control**

Prior to the study, all participants were informed of the study, given a chance to ask questions, and completed the consent form (Appendix D) if willing to participate. To protect the privacy of all participants, the data collected for this project was stored in a locked file cabinet accessible only by the researcher within a faculty office. No personal identifying information was stored with the data collected. Additionally, no participants’ names and personal identifying information was used in any published reports or presentations of the research. Participants received IPE credit but participation or performance in the simulation was not linked to a grade. All information gathered during the study will be destroyed two years after completion of the project.

To control for quality of responses to the ECCAI surveys, participants were told there were no right or wrong answers and their responses would not be linked to their names. They were told to respond to the questions honestly and rate the degree of confidence they felt in performing each of the skills as of now. Bandura (1986) suggested when constructing self-efficacy scales, the participants should be asked to “rate the strength of their belief in their ability to execute the requisite activity” (p. 313). This guide was used in supplementing the written instructions on the ECCAI survey with verbal instructions.

**Summary**

This study used a pretest-posttest quantitative quasi experimental design to evaluate the effects of a high fidelity simulation on the perceived self-efficacy of athletic
training students. A convenience sample of 46 undergraduate students was used and participants were placed randomly into groups of four. Two members of the group were randomly selected to participate in a high fidelity simulation as active responding participants and the other two in the group were selected to strictly observe the simulation and instructed to not intervene.

The ECCAI survey instrument was developed as part of the Dissertation with the purpose of measuring self-efficacy. The aim of this study was to design an evidence-based solution to provide deliberate practice opportunities to athletic training students that would result in increased perceived self-efficacy relating to emergency cardiovascular care. This addressed the central question: what is the difference in self-efficacy scores of athletic training students prior to and following participation in or observation of a high fidelity cardiovascular emergency scenario utilizing the Laerdal® SimMan?
CHAPTER FOUR: FINDINGS

Introduction

The purpose of this quantitative quasi experimental study was to determine whether participation in a high fidelity simulated cardiovascular emergency scenario using the Laerdal® SimMan increased undergraduate athletic training students’ self-efficacy scores in a university simulation center in the United States. This chapter begins by reviewing the data analytic strategy employed and presenting the results of the research questions. This chapter concludes by presenting several post hoc test analyses that further clarify the findings.

Data Analysis

Responses from the ECCAI survey instrument were recorded and analyzed in the IBM SPSS Statistical Package for Windows (Version 21; SPSS). Following the recommendations of Tabachnick and Fidell (2007) on how to analyze multivariate statistics, data were screened for accuracy, missing data, univariate outliers, and normality. No violations to the assumptions about the data were found.

Power Analysis

The program G*power (Faul, Erdfelder, Lang, & Buchner, 2007) was used to conduct a sensitivity power analysis. Using the setting for the F test family, specifically ANOVA repeated measures with between factors and given that there were 46 students in the cohort, 2 groups, 3 repeated measurements, minimum $r = .472$ among repeated measures, with $\alpha = .05$, and power at 95%, we could detect effect size of Cohen’s $f = .4375$. Using the formula $\eta^2 = \frac{f^2}{(1 + f^2)}$ (Cohen, 1988, p. 276), the Cohen’s $f$ converted to an eta squared value of $n^2 = .16$. Cohen’s conventions for interpreting partial eta squared
effect size in a repeated measure ANOVA are as follows: .02 is small, .13 is medium, and .26 is a large effect size. The value of .16 places this study at a medium to large effect size.

Results

Forty-six second and third year athletic training students participated in the study. Descriptive variables included year in the athletic training program, gender, age, number of years of prior CPR certification, additional lifeguard or EMT certifications held, prior participation in a real-life cardiovascular emergency experience, and prior participation in a high fidelity simulation. Demographic data describing the sample are provided in Chapter 3, Table 1.

Self-Efficacy Pretest, Posttests Results

Responses to the 20-question ECCAI survey were totaled for each participant’s pretest, posttest (immediate), and posttest (6 month) and the mean scores were compared between the two groups: participation and observation. Descriptive statistics for total mean values are reflected in Table 2. A general linear model repeated measures ANOVA (pretest, posttest immediate, posttest 6 month) with a between-subject factor (participation vs. observation) was used to compare the mean scores. Following the significant ANOVA tests, post-hoc tests were conducted using the Tukey’s honest significant difference (HSD) test to compare mean differences within groups.
Table 2

Demographic Descriptions of Mean ECCAI Survey Results

<table>
<thead>
<tr>
<th>Measure</th>
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<td>1.04</td>
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Hypothesis One: Overall Simulation Efficacy

Hypothesis one stated that participation in or observation of a high fidelity cardiovascular emergency simulation will increase self-efficacy among all participants and observers. A 3 x 2 repeated measures ANOVA (Measure: pretest, posttest immediate, posttest 6-month x Group: participant vs. observer) was used to test Hypothesis 1 followed by a series of Tukey’s HSD post hoc analyses to identify the location of mean differences. There was a significant main effect for the three repeated measures ($F(2, 43) = 12.73, p < .001, \eta^2_p = .37$) with the scores steadily increasing significantly from pretest ($M = 7.60, SD = 1.13$) to posttest ($M = 8.04, SD = 1.22, p = .001$), then again to the 6 month posttest ($M = 8.38, SD = 1.04, p = .04$). Mauchly's test of sphericity was not significant at the .01 level recommended as a minimum cutoff by Tabachnick and Fidell (2007), ($W(2) = .85, p = .027$) indicating that the assumption of sphericity had been met. Hypothesis 1 was supported.
Hypothesis Two: Participation and Observation Effects

Hypothesis two stated that those who participated in a high fidelity cardiovascular emergency simulation would have higher self-efficacy scores than those who observed the simulation. A 3 x 2 repeated measures ANOVA (Measure: pretest, posttest immediate, posttest 6-month x Group: participant vs. observer) was used to test Hypothesis 2. There was not a significant between-subjects main effect for group ($F(1, 44) = .83, p = .37, \eta^2_p = .018$). Scores among the participants ($M = 8.21, SD = 1.03$) were not significantly higher than scores among the observers ($M = 7.85, SD = 1.40$). It is clear from the overall non-significant group effect that there were no differences between groups at any of the levels (pre-test, post-test immediate, and post-test 6 month). Therefore, it was not necessary to conduct follow up post hoc analyses to evaluate mean differences between groups. Hypothesis 2 was not supported and is represented in figure 1. There were no differences between self-efficacy score gains between those that participated and those that observed a high fidelity cardiovascular emergency simulation. A Levene’s Test of Equality of Error Variances was not significant at the .01 level recommended by Tabachnick and Fidell (2007), $F(1,44) = 3.56, p = .07$, indicating that the assumption of homogeneity of variance had been met for the between subjects factor.
Hypothesis Three: Persistence of Effects

Hypothesis three stated high fidelity simulation effects on self-efficacy ratings would persist at 6 months after participation in or observation of a high fidelity cardiovascular emergency simulation. The same 3 x 2 repeated measures ANOVA used to test the first two hypotheses was also used to test Hypothesis three, followed by a series of Tukey’s HSD post hoc analyses to identify individual mean differences. As noted previously, there was a significant main effect for the three repeated measures ($F(2, 43) = 12.73, p < .001, \eta^2_p = .37$). Tukey’s HSD post hoc analyses revealed scores at the 6
month follow up posttest \((M = 8.38, \, SD = 1.04)\) significantly increased from immediately following the simulation posttest to the 6 month follow up posttest \((p = .04)\). Therefore there was a significant increase in self-efficacy rating from immediate post-test to 6 month follow up posttest. Hypothesis 3 was supported.

**Second and Third Year Athletic Training Student Clarification Analysis**

In order to better understand the nature of the increase from posttest immediate to 6-month follow up, a post hoc analysis was conducted using a 2 x 2 repeated measures ANOVA (total score from posttest immediate to posttest 6 month) with a between subjects factor (second year vs. third year students). As was expected based on the previous analysis, there was a significant main effect for change in total score from posttest to follow up \((F(1,44) = 4.84, \, p = .04, \, \eta^2_p = .09)\), but there was not a significant interaction for year in athletic training between second year students \((M = 8.67, \, SD = 0.95)\) and third year students \((M = 8.12, \, SD = 1.06)\) on the posttest \((F(1,44) = .081, \, p = .79, \, \eta^2_p = .002)\) indicating that both cohorts of students did not significantly differ from posttest to follow up.

Other than progression in the professional athletic training program, the only other descriptive difference between these two groups is that the third year athletic training student group had previously participated in one high fidelity simulation greater than one year prior to the study. The second year athletic training student group had no prior experience in high fidelity simulation. The post hoc ANOVA analysis served to answer if the first time an individual completes a high fidelity simulation, it has more of an impact over time than subsequent encounters in a simulation lab. There was not a significant difference between second year or third year students following the simulation
and over time indicating this difference had no impact on the perceptions of self-efficacy. To confirm there were no differences between the groups prior to the study, I conducted an independent sample t-test exploring the mean self-efficacy scores of second year and third year athletic training students prior to the simulation. There was no significant difference between groups with second year ($M = 7.58, SD = 1.00$) and third year students ($M = 7.63, SD = 1.25$) indicating year in program and previous simulation experience had no impact on the self-efficacy scores of athletic training students on pre-test.

**Summary**

Responses from the ECCAI survey instrument were recorded and analyzed to answer the three hypotheses in this study. Results concluded both participation in and observation of a high fidelity CPR simulation had a significant positive effect on the perceived self-efficacy of athletic training students though there were no differences in self-efficacy gains between the groups. Additionally, there was a significant increase in perceived self-efficacy of athletic training students 6-months after completion of a high fidelity CPR simulation. Exploratory analyses using a between subject factor revealed there was no significant difference between level in the athletic training program (second vs. third year student) even though the third year students all had previous simulation experience.
CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

Introduction

Perceived self-efficacy is directly related to knowledge application and clinical competence. Bandura and Cervone (1986) explain that individuals who perceive they are capable of a successful performance are more likely to participate in tasks that occur within that self-efficacy range. Additionally, if individuals believe a task is beyond their self-perceived ability, they are more likely to avoid participation in that task. This relates to athletic training because if a student perceives they are inadequate at responding to a particular event, they may not apply certain skills or hesitate before providing treatment. This could adversely affect patient outcomes especially in situations that require immediate response such as cardiovascular emergencies.

Literature suggests that the use of high fidelity simulation is a way to provide medical and health care students with deliberate practice opportunities for low incident, high risk events such as cardiovascular emergencies (Perkins, 2007; Wayne et al., 2006). Within athletic training education, students participate in clinical rotations to practice skills learned within the classroom in a real-world environment. Some of those skills, such as emergency cardiovascular care, are rarely occurring within traditional athletic training settings and therefore students may not have the chance to practice and gain the competency and the confidence needed to master these skills.

Purpose of the Study

Given that levels of perceived self-efficacy are malleable and high fidelity simulations can provide many positive outcomes, the purpose of this quantitative quasi experimental study was to determine whether participation in a high fidelity simulated
cardiovascular emergency scenario using the Laerdal® SimMan increased undergraduate athletic training students’ self-efficacy scores in a university simulation center in the United States.

**Aim of the Study**

The aim of this study was to design an evidence-based solution to provide deliberate practice opportunities to athletic training students that would result in increased perceived self-efficacy relating to emergency cardiovascular care.

**Proposed Solution**

Perceptions of self-efficacy can be described as the belief or confidence level in which an individual feels capable of producing a specific desired outcome. In his explanation of the implications of self-efficacy theory, Bandura (1986) states “competent functioning requires both skills and self-beliefs of efficacy to use them effectively” (p. 391). Further, according to Bandura (1977), there are four sources of information that contribute to the self-belief of an individual which affects personal self-efficacy: performance attainment, vicarious experiences, verbal persuasion, and personal physiological status. In this study, the effects on self-efficacy of athletic training students following performance attainment and vicarious experiences in a high fidelity cardiovascular emergency simulation were measured.

Bandura (1977) reveals the most influential source of information is performance attainment and that vicarious experiences are less influential than performance attainment, but more commonly contributors to perceived self-efficacy because they occur more frequently. The current study identified that the perceived self-efficacy of athletic training students significantly increased following participation in or observation
of a high fidelity cardiovascular emergency simulation but there are no differences between the two groups; both performance attainment and vicarious observation experiences have an equal impact on improving the self-efficacy scores of athletic training students related to CPR skills and abilities.

Based on the results of this study, it is recommended that annual high fidelity cardiovascular emergency simulations be incorporated into professional athletic training programs.

Support for the Solution

An increase in perceived self-efficacy following a high fidelity simulation is consistent with findings reported in anesthesia (Gee, 2006), nursing (Blum, et al., 2010), surgical training (Gordon, et al., 2001), and emergency medicine (Sahu & Lata, 2010). The current study provides evidence that the perceived self-efficacy of athletic training students who participate in or observe a high fidelity cardiovascular simulation increases.

The proposed solution does not differentiate between athletic training students having the opportunity to either participate in or observe a high fidelity cardiovascular simulation. The current study provides evidence that there is no difference in self-efficacy gains between athletic training students who participate in a high fidelity simulation and those that observe one; both groups’ self-efficacy increases. This finding is consistent with the literature providing evidence of the positive learning opportunities for the observer role in a high fidelity simulation (Hober & Bonnel, 2014; Jeffries & Rizzolo, 2006). For example, in a multi-site study of 908 nursing students, Jeffries and Rizzolo (2006) studied the effects of knowledge, performance, confidence with performing skills, and satisfaction with the learning strategy (simulation-based learning).
In this pre-test/post-test experimental design focused on nursing postoperative and postpartum clinical skills, the researchers found that there was no difference between student learning outcomes related to confidence and satisfaction between the participant and observer role following a high fidelity simulation.

Hober and Bonnel (2014) evaluated strategies to engage nursing student observers \( (n = 23) \) in a high fidelity simulation. Through qualitative interviews, this study found that providing observers an opportunity to conceptualize the learning experience, capture the big picture, and connect with the team (all achieved in the debriefing to follow the simulation) allowed those in the observer role to feel engaged and valued as a team member (Hober & Bonnel, 2014). Other studies (Stegmann, Pilz, Seibeck, & Fischer, 2012; Traynor, Gallagher, Martin, & Smyth, 2010) supported the benefits in increased self-confidence, clinical proficiency, and patient safety for students in the observer role when they are actively engaged in viewing the simulation and the subsequent debriefing.

Bethards (2014) and Harder, Ross, and Paul (2013) report alternative findings about the observer role indicating a lack of student engagement and less enthusiasm for this role as compared to the hands-on active role. In one study with undergraduate nursing students, Harder, Ross, and Paul (2013) conducted a focused ethnographic study to discover the culture of learning and factors that affect student learning in a high fidelity simulation. The researchers found students preferred to be assigned to active roles within a high fidelity simulation so they could participate in hands-on learning rather than to be relegated to an observer role where they expressed frustration that they were not able to be as involved as their peers. Harder, Ross, and Paul (2013) explain that one cause of these findings with the small sample \( (n = 12) \) surveyed is the observers simply
watched the high fidelity simulation and then did not actively participate in the debriefing to follow.

In 2013 the International Nursing Association for Clinical Simulation and Learning developed a set of seven standards to address the best practices for a high-fidelity simulation (http://sirc.nln.org/). While these standards do not specifically differentiate between the active and observer roles, application of the observer role can be integrated into several of the standards such as the debriefing to provide the best opportunity for students. Those that design the integration of high-fidelity cardiovascular simulation into professional athletic training programs should follow the best practices of these standards and supporting literature by incorporating all students (participation and observation) into active participation in the debriefing to follow the simulation so that benefits of increased self-efficacy are maximized for both roles.

I suggest the solution include annual cardiovascular emergency simulation in professional athletic training programs. In a comparison of low and high-fidelity CPR training over time, Hoadley (2009) found those that participated in high-fidelity training had a significant increase in self-confidence that was retained over time (6 months) as compared to those that participated in low-fidelity training. Additionally, within the group that participated in a high-fidelity simulation, the current study found that not only is the perceived self-efficacy of athletic training students maintained over a 6-month time period, but it actually increases over this time as compared to immediately post-simulation (Hoadley, 2009). The proposed solution recommends when feasible, annual high-fidelity CPR simulation to be integrated into professional athletic training programs.
Evidence suggests this will have a positive effect on the perceived self-efficacy of athletic training students that will increase over time (Hoadley, 2009).

Annual high fidelity simulation in professional athletic training programs was recommended as the proposed solution because previous literature supports the long-term retention of confidence and clinical proficiency to be maintained over a one-year time period. The long-term retention of ECC techniques has been reported to be maintained over a one-year time period for those participants that complete a high fidelity simulation in nursing, emergency medicine, and anesthesia (Ackermann, 2009; Boet, et al, 2011; Wayne et al., 2008). Further, in a comparison study of high fidelity simulation and case study presentation on nurse practitioner students’ confidence and knowledge in managing cardiac events, Scherer, Bruce, and Runkawatt (2007) found the confidence gains achieved from those that participate in a high fidelity simulation relate to clinical knowledge and competency. The confidence an individual has in their ability to perform certain clinical skills affects their clinical performance (Bandura, 1986). Thus, studies demonstrating maintenance of successful clinical performance over a one-year period further support the retention of self-efficacy over this duration.

**Stakeholders Related to Integration of High Fidelity ECC Simulation**

The main stakeholders related to the proposed solution are athletic training students and faculty within professional athletic training programs and the patients who receive ECC in the future. While the functions of athletic training students and faculty are quite different, the overall goal of each is the same; the development of qualified and competent health care providers. Athletic training students dedicate time to studying within didactic settings and then apply their skills as they participate in clinical
experiences with the goal of developing proficiency in these areas so that they may function eventually as competent certified athletic trainers. Faculty within professional athletic training programs have the challenge of providing classroom and clinical opportunities for athletic training students to develop the knowledge, skills, and confidence to be successful in the field of athletic training. The patients who receive ECC in the future are dependent on the athletic training student to have clinical proficiency with this skill and self-efficacy in his or her ability to perform this life-saving treatment.

**Policies Influenced/Influencing Integration of High Fidelity ECC Simulation**

The Commission on Accreditation of Athletic Training Education (CAATE) requires competencies to be instructed and evaluated within each accredited athletic training program (CAATE, n.d.). A professional athletic training program must continually demonstrate their ability to provide students with opportunities to achieve these competencies to maintain accreditation with CAATE. However, CAATE does not make specific recommendations on the method of achieving these competencies.

One of the CAATE competency areas is acute care of injuries and illnesses which includes emergency cardiovascular care. Cardiovascular emergencies are rare within the traditional athletic training setting and therefore opportunities for athletic training students to practice these skills clinically are rare. The current study supports the use of a high fidelity cardiovascular emergency simulation as an education strategy to assist athletic training students in the development of self-efficacy related to these skills.

**Potential Barriers and Obstacles to Integration of High Fidelity ECC Simulation**

Numerous studies report high levels of satisfaction with high fidelity simulation as a learning method from those that participate in this type of training (Blum, Borglund,
& Parcells; Hoadley, 2009; Wooton, Davis, Button, & Kelton, 2010). Wooton, et al. (2010) studied the perceptions of third-year undergraduate nursing students \((n = 300)\) about the integration of a high fidelity simulation into an existing clinical skills course. Findings reported that students perceived high fidelity simulation to be enjoyable and rated their satisfaction with their participation high (Wooton et al., 2010). Further, Wooton et al. (2010) reported the nursing students thought that high fidelity simulation was very challenging but appropriately related to the application of concepts they studied in courses. Therefore, resistance to participation in a high fidelity simulation is not anticipated for athletic training students.

There is a potential barrier on behalf of the athletic training faculty. The design and execution of running a high fidelity simulation takes a great deal of time and familiarity with the associated computer software. In a study of simulation based education in postgraduate education for anesthesiologists, Savoldelli, Naik, Hamstra, and Morgan (2005) reported eighty-one percent of staff \((n = 40)\) who were surveyed about the incorporation of simulation-based training into the curriculum perceived time to be at least one significant barrier. While staff reported they understood the benefits high fidelity simulation may provide to the students, they were concerned that they would not be able to dedicate the time required to properly design the simulations, train on the equipment (hardware and software), and carry out the scenarios.

Echoing these findings, in a survey conducted by the National Council of State Boards of Nursing in the United States, the most common barrier to the incorporation of simulation in nursing programs was that faculty members were concerned of the time commitment and lack of training in facilitating simulation (Hayden, 2010). However, the
survey results do state that nursing faculty members would feel less resistant to the incorporation of simulation if proper design and facilitation training was provided (Hayden, 2010).

To address this barrier, the leader should consider a faculty development plan that includes best practices and training on designing, implementing, and evaluating simulation as a teaching strategy for faculty in professional athletic training programs. It is possible the best method of facilitating this plan would be the selection and development of a core group of athletic training faculty to be responsible for the simulations.

**Financial/Budget Issues Related to Integration of High Fidelity ECC Simulation**

Perhaps the most significant barrier to the implementation of annual high fidelity cardiovascular emergency simulation into professional athletic training programs is the cost. According to the Laerdal Medical Products catalog (2012), the SimMan mannequin hardware (without associated software) costs approximately $20,000 whereas the higher-fidelity SimMan 3G mannequin capable of displaying neurological and physiological symptoms costs just over $66,000. Compared to the low fidelity alternative (plastic head/foam body) which averages $50 each (Laerdal Medical Products catalog, 2012), this is a significant difference in hardware cost and poses a financial barrier.

In addition to the hardware required for high fidelity simulation equipment, there are several more required components with associated costs. Most significantly, the high fidelity mannequin is a complex piece of equipment that requires a specifically designed clinical laboratory that can support it (Tuorineimi & Schott-Baer, 2008). Hravnak, Tuite, and Baldisseri (2005) report an estimated range from $200,000 to almost $1.6 million to
design, and implement a dedicated space needed for the high fidelity mannequin and associated patient care equipment. This financial commitment also involves the ongoing cost of running and maintaining the hardware, software, and equipment.

The leader should address these financial barriers by creating a business plan that includes buy-in from funding sources and administrative leadership. Additionally, leaders in professional athletic training programs should seek shared cost opportunities with other medical and healthcare programs such as nursing within the university since the benefits and application of high fidelity simulation can be applied to the teaching and training of many medical and healthcare students.

The equipment needed in high fidelity simulation is costly, however the cost that a health care provider, school board, or university may incur should a cardiac death occur result in a lawsuit is compelling. The costs associated with the death or long-term permanent disability of a young person may be considerable. The victim (or family of the victim) has the opportunity for negligence claims against the healthcare provider based on the care that was delivered. For example, the wrongful death lawsuit filed by the family of a Hartsville High School football players who collapsed and died of cardiac complications in 2012 received a $260,000 settlement from the South Carolina Board of Education (Cross, 2016). One of the multiple findings in this investigation was that the athletic trainer did not provide adequate CPR to this athlete following his collapse (Cross, 2016). Though health care providers and professional education programs should not structure learning goals on protecting against lawsuits, it is important to provide students with opportunities to advance their self-efficacy and clinical competence. This may secondarily impact the potential for medical negligence lawsuits.
Ethical Issues Related to Integration of High Fidelity ECC Simulation

The current study provides evidence as to the effectiveness of a high fidelity simulation as a method for increasing the self-efficacy of athletic training students related to cardiovascular emergency care. In a description of self-efficacy theory, Bandura (1986) explains that individuals who perceive they are capable of a successful performance are more likely to participate in tasks that occur within that self-efficacy range. Additionally, if an individual believes a task is beyond their self-perceived ability, they are more likely to avoid participation in that task. Therefore, if athletic training students perceive they are inadequate at responding to a cardiovascular emergency, they may not apply certain skills or hesitate before providing life-saving treatment. This would adversely affect patient outcomes and could lead to a situation where the death or permanent disability of a patient could have been prevented had an athletic training student responded differently. Therefore, enhancing self-efficacy of athletic training students may improve patient outcomes.

Understanding self-efficacy facilitates knowledge and clinical performance and that high fidelity cardiovascular simulation improves self-efficacy presents an ethical issue. The current study demonstrates that athletic training students who have undergone traditional ECC training on low fidelity equipment have lower self-efficacy than after they participate in or observe a high fidelity simulation. Athletic training students are unlikely to encounter an emergency cardiovascular scenario within their clinical rotations, therefore, if an athletic training student does not participate in a high fidelity cardiovascular simulation, their perceived self-efficacy in this skill will remain less than it could be with the high fidelity training. Faculty in professional athletic training
programs will face an ethical dilemma as they now will know high fidelity simulation will provide an opportunity for athletic training students to increase their self-efficacy related to this skill. Low self-efficacy in emergency cardiovascular skills could adversely affect true patient outcomes if the athletic training student were to encounter an ECC event in clinical practice.

**Change Theory**

Research evidence on a proposed solution is just one of the factors that contributes to the adoption and success of a new clinical or educational strategy. According to Sanson-Fisher (2004), research on the diffusion of innovation theory suggests a number of factors contribute to the adoption of a new behavior or technique for clinical change. Rogers (2003) developed a theoretical framework focused on the diffusion of innovation that identifies five elements of a new behavior contribute to the rate and success of a new activity. These include relative advantage, compatibility, complexity, trialability and observability (Rogers, 2003). According to Rogers (2003), relative advantage is the “degree to which an innovation is perceived to be better than the idea it supersedes” (p. 15), compatibility is the “degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters” (p. 15), and complexity is the “degree to which an innovation is perceived as difficult to understand and use” (p. 16). The remaining two elements in the diffusion of innovation theory include trialability and observability. According to Rogers (2003), trialability is defined as the “degree to which an innovation may be experimented with on a limited basis” (p. 16) and observability is the “degree to which the results of an innovation are visible to others” (p. 16).
Sanson-Fisher (2004) suggests that adoption of the best evidence-based practice is not achieved by simply using the literature to propose a solution, but must address the five elements of diffusion of innovation theory. The following section describing implementation of high fidelity cardiovascular emergency simulation in professional athletic training programs will address each of the five elements of diffusion of innovation theory.

**Implementation of High Fidelity ECC Simulation in Athletic Training**

Using the best practice approach to simulation program development of Seropina, Gavilanes, Brown, & Driggers (2004) I would implement high fidelity simulation into professional athletic training programs through a series of eight steps. These steps include: “1) developing a vision; 2) creating a business plan; 3) seeking buy-in from funding sources and executive leadership; 4) constructing the facility and purchasing equipment; 5) equipment training; 6) developing the curricula; 7) faculty development; and 8) determining policies and procedures” (p. 171).

**Factors Related to the Implementation ECC High Fidelity Simulation**

I heavily considered the five elements of Rogers (2003) diffusion of innovation theory in the selection of the eight steps feeling this implementation plan will sufficiently address relative advantage, compatibility, complexity, trialability, and observability of simulation in professional athletic training programs.

**Relative advantage.** Research that contributes to developing a vision and creating a business plan both contribute to the degree to which high fidelity cardiovascular simulation will be perceived as better than the current use of low fidelity
CPR training. Objective data from the current study can be used to support the benefit on self-efficacy that could be expected with the proposed plan.

Vision development allows stakeholders to understand the scope of the proposed solution. The vision development could address the structure of where and how high fidelity cardiovascular emergency simulation would fit into professional athletic training programs. The vision would also include describing how it would impact athletic training students and why it would be important for this population to have increased self-efficacy related to this skill.

The business plan would quickly follow the vision development and takes the information presented in the vision and puts it into a concise and understandable form. The business plan would show direction of the implementation of high fidelity simulation and how the stakeholders (administration and faculty) would contribute.

**Leader’s role in relative advantage.** It will be important for a leader to communicate with existing faculty in professional athletic training programs to address their perceptions of current modes of CPR training and educate them on what outcomes high fidelity simulation can provide as compared to low fidelity training. Simulation as an educational tool inherently makes sense because it provides students with a hands-on learning experience (Sanson-Fisher, 2004). However, the challenge for leaders will be to demonstrate validity of this tool as making significantly more of an impact than low fidelity hands-on training. Channels of communication that could be used to convey this information would include sharing research publications (including the present study), workshops, videos of simulation, and question-and-answer sessions.
Compatibility. According to Rogers’s (2003) diffusion of innovation theory, to increase the probability that stakeholders within professional athletic training programs adapt high fidelity simulation, they must perceive current CPR training to be a problem. This is part of the buy-in step to plan implementation. The current study and previous literature support the use of high fidelity simulation as an effective method to increase self-efficacy which has a subsequent effect on the clinical competence of participants (Ackermann, 2009; Blum, et al., 2010; Epstein & Hundert, 2002). Teaching and training techniques to improve clinical competence are compatible with goals within healthcare education programs and have a direct effect on true patient outcomes (Ericsson, 2004).

Leader’s role in compatibility. Leaders can use the well-developed vision and business plan with the hope of achieving buy-in from stakeholders and administrators which include funding sources and executive leadership. It will be important for the leader to convey enthusiasm for high fidelity simulation development while also stressing the need for this method of cardiovascular emergency scenario training.

Complexity. What I consider to be the biggest factor affecting the implementation of high fidelity simulation into professional athletic training programs is the complexity or degree to which simulation is perceived as difficult to understand and use. Faculty many have insufficient expertise in designing simulations and using the computer equipment. Additionally, Savoldelli, Naik, Hamstra, and Morgan (2005) identified the most common barrier for staff conducting simulation was the lack of free time. One of the reasons athletic training faculty may feel they do not have adequate time to design and implement high fidelity cardiovascular emergency simulation is that they feel it is too complex as compared to the current method of training.
Assistance from the leader with facility construction and equipment purchasing as well as equipment training will contribute to alter the perception of difficult complexity for the implementation of this solution (Sanson-Fisher, 2004).

**Leader’s role in complexity.** Leaders can significantly impact the perception of complexity within the implementation of high fidelity simulation. First, leaders can seek outside expertise from others who have constructed simulation facilities. This can provide a collaborative environment to assist with the step of facility construction and equipment purchasing. Next, leaders should select individuals within the athletic training faculty and begin equipment training on simulation software. Without proper high fidelity simulation software and hardware training, individuals will only gain a basic understanding of the equipment (Sanson-Fischer, 2005). Faculty need to understand what the equipment is capable of doing as well and how they can use the components to achieve their educational goals.

**Trialability.** The steps of curriculum development and determining policies and procedures will contribute to the trialability of simulation implementation. Sanson-Fisher (2004) explains that the ability of individuals to test potential interventions on a limited basis and proceed in logical and tested standards increases the trialability of an innovation. Further, Rogers (2003) argues that for individuals to adopt an innovation, they must have faith that the evidence is correct and implementation is following a logical process.

**Leader’s role in trialability.** Curriculum development as well as determining policies and procedures all provide an infrastructure that faculty within professional athletic training programs can utilize when implementing high fidelity simulation. It will
be important for the leader to communicate that refinement to these steps is welcomed and will be ongoing. As the needs, degree, and level of institution and program buy-in change over time, the curricula, policies, and procedures will likely change (Seropian et al., 2005). The leader has the important role in this process to communicate to professional athletic training faculty that these changes are anticipated and welcome. This will increase the trialability or the level in which simulation implementation may be trialed and modified.

**Observability.** The last element to the adoption of a new innovation is the degree to which the results are visible to others, or the observability (Rogers, 2003). Sanson-Fisher (2004) explains that when an innovation is visible to others, it stimulates peer discussion, collaboration, and increased buy-in from others. Faculty development is an important step I have identified in the implementation plan that will contribute most to the observability of high fidelity simulation in professional athletic training programs. After faculty are trained on the equipment, they must be given opportunities to see and experience the technology (Seropian et al., 2005). Testing the equipment and experiencing simulation for themselves will allow them to observe the outcomes of high fidelity cardiovascular simulation.

**Leader’s role in observability.** Sanson-Fisher (2004) describes the leader to have a great effect on the perceived observability of an innovation. If the leader is respected and provides a charismatic attitude, there is a greater chance that others will adapt the innovation (Sanson-Fisher, 2004). Therefore, if the leader is allowing athletic training faculty to test the simulation equipment and experience simulation first-hand, they should approach it by creating a nonthreatening environment for the participants. Requiring
athletic training faculty to participate in a complex crisis simulation as their first introduction to the experience is not a prudent starting point and may create an environment of distrust. The faculty should be allowed to train by progressing through the equipment and experiences in a way that builds trust and allows them to make a full and honest evaluation of the components of high fidelity simulation.

Additional Considerations for Implementation and Assessment

As part of ongoing implementation and assessment of the integration of high fidelity simulation into professional athletic training programs, one other option should be considered. In an evaluation of the implementation of a high fidelity simulation program in a community college setting, Tuoriniemi and Schott-Baer (2008) recommend hiring a dedicated simulation coordinator faculty member. High fidelity simulation requires technical and methodological expertise (Tuoriniemi & Schott-Baer, 2008). A coordinator can work with faculty members within the athletic training program who can serve as content experts to create simulation designs more efficiently.

Due to budget restrictions and time commitments, hiring of a simulation coordinator is usually an approach when multiple departments within a university are all utilizing a shared simulation lab (Savoldelli et al., 2005).

Global / External Implications of the Integration of High Fidelity ECC Simulation

In 2010, the American Board of Anesthesiology became the first medical specialty to require high-fidelity simulation as a standard component to maintaining board certification. Participation in a multimodality high fidelity simulation course is now required every ten years for a diplomat to maintain board certification as part of the
Maintenance of Certification in Anesthesiology (MOCA) requirement (Levine, Flynn, Bryson, & DeMaria, 2012).

Certified athletic trainers are required to maintain board certification through the Board of Certification (BOC). Currently the BOC requires athletic trainers renewing certification to provide proof of current ECC certification along with participation in continuing education requirements. It has been identified that athletic training students lack the deliberate practice opportunities to develop self-efficacy and clinical competency in cardiovascular emergencies because this is a low incident or rarely occurring event in traditional athletic training settings. Therefore, it would be expected that certified athletic trainers who are working in these settings would also rarely encounter clinical situations where they would have to utilize their ECC skills.

High fidelity training is important for those in both low incident settings such as athletic training as well as high incident setting such as hospital intensive care units (ICU). Wayne et al. (2008) reported that during a code event within an ICU, physicians and nurses displayed poor adherence to the American Heart Association (AHA) guidelines during cardiovascular emergencies not meeting AHA guidelines with the depth and rate of chest compressions. Considering the implications of the current study and the lack of deliberate practice cardiovascular care opportunities in athletic training settings, a global consideration would be if the BOC should adopt a high fidelity simulation course for all athletic trainers as part of a board certification maintenance requirement.
**Evaluation and Timeline for Implementation and Assessment**

The timeline for integration of high fidelity simulation into professional athletic training programs will greatly depend on if the institution already has a high fidelity simulation lab and equipment. If the institution already has this equipment as the university where the current study took place did, the implementation timeline is relatively short as steps to seek buy-in from funding sources, construct the facility, and purchase equipment would be unnecessary. Since some professional athletic training programs will already have access to high fidelity simulation equipment, I will break the implementation plan timeline into two phases.

**Timeline.** Phase one will include developing a vision, seeking buy-in from funding sources, constructing the facility, and purchasing equipment. I would budget approximately two years for these steps to occur with buy-in of funding sources and allocation of resources to be the greatest hurdle. As a faculty member, I am aware that budgets are set one year in advance within institutions. Therefore, it would not be realistic to propose a large purchase and expect there to be room in the current academic years’ budget to make those expenses. Likely, if a leader could get buy-in from administration for high fidelity simulation equipment, it would not be until the following academic year until that equipment could be ordered.

The second phase will include equipment training, developing the curricula, faculty development and determining policies and procedures. I estimate the timeline for implementation of this phase to be between six months and one year. This will include an investigation into the current course sequence within a professional athletic training program and identification of potential courses that could absorb high fidelity
simulations. Alternative, programs could decide within their curricula that high fidelity simulation best fits into a clinical requirement not affiliated with a particular course and they could design workshops or lab times outside of a particular course to offer this to athletic training students. This will take some time and consideration and following this step, it will take time to get faculty trained on equipment which is why I estimated six months to one year.

**Assessment.** Assessment of high fidelity cardiovascular emergency simulation should occur annually as part of the ECC recertification process. Assessment should include an evaluation of perceived self-efficacy with CPR skills for each athletic training student. I propose professional athletic training programs should utilize the ECCAI survey from this study as part of the recertification process. This survey should be distributed to each athletic training student and tracked annually to make sure that perceived self-efficacy for these related CPR skills remains high. Maintenance of increased self-efficacy over time will provide validation that the high fidelity simulations are effective as an educational tool practicing this clinical skill. It is important to note that the actual clinical skill proficiency assessments required for ECC recertification should remain as part of a professional athletic training program. The additional of an assessment to measure the perceived self-efficacy of athletic training students will supplement the clinical skill proficiency assessments and provide validation of the effectiveness of the high fidelity training on perceptions of self-efficacy.
Implications

Practical Implications

The current study demonstrated that the self-efficacy of athletic training students related to cardiovascular emergency skills improved after high fidelity simulation. This is significant to the overall teaching and training of athletic training because self-efficacy facilitates knowledge and clinical performance (Murphy & Kraft, 1993). Bandura and Cervone (1986) explain that individuals who perceive they are capable of a successful performance are more likely to participate in tasks that occur within that self-efficacy range. Additionally, if an individual believes a task is beyond their self-perceived ability, they are more likely to avoid participation in that task. Based on this, it would be of concern that an athletic training student may not apply certain skills or hesitate before providing treatment because they lack the self-efficacy for cardiovascular emergency management. This could adversely affect patient outcomes.

It is important to note that while the current study demonstrated a significant increase in self-efficacy following high fidelity simulation, the self-efficacy of athletic training students was rather high to begin with shifting from about a seven to an eight on an 11 point scale. It is possible that the athletic training students rated their self-efficacy relatively high on pre-test because the scale asked about their efficiency expectations related to the tasks required to respond to a cardiac emergency. Efficiency expectations related to the higher level self-regulatory analysis was not measured in the present study. Self-regulatory expectations would measure a student’s self-efficacy related to continuing treatment in the face of challenges and adversity such as the feeling of breaking the patient’s rib or a delay in EMS to respond to the scene. Perhaps if the ECCAI scale asked
students to evaluate their self-efficacy related to these self-regulatory components rather than strictly tasks required for response, they would have rated their pre-simulation self-efficacy levels as less than they did in the current study.

Literature suggests that the use of high fidelity simulation is a way to provide medical and health care students with deliberate practice opportunities for low incident, high risk events such as cardiovascular emergencies (Perkins, 2007; Wayne et al., 2006). The current study supports the literature. Cardiovascular emergencies are rarely occurring within traditional athletic training practice settings and therefore students lack the deliberate practice opportunities for this skill. One advantage of high fidelity simulation as compared to low fidelity task training is that it strives to provide participants with a safe and realistic environment to practice clinical skills. It is evident through the effects on self-efficacy that athletic training students in the current study were able to sufficiently suspend reality and become immersed in the simulation scenario. This is significant because it provides support for the use of this educational tool as an effective method of providing deliberate practice opportunities for athletic training students to improve their skill and increase self-efficacy related to CPR techniques.

**Implications for Future Research**

The self-efficacy gains following participation in a high fidelity simulation were assessed in this research study at 6 months following simulation to determine if self-efficacy gains would be maintained over time. Post hoc analyses within the current study revealed from posttest (immediately following participation in a high fidelity simulation) to follow up six months later, there were no differences between the second year students after the training than third year athletic training students. Other than progression in the
professional athletic training program, the only other descriptive difference between these two groups is that the third year athletic training student group had previously participated in one high fidelity simulation greater than one year prior to the study. The second year athletic training student group had no prior experience in high fidelity simulation. It would be interesting to explore if year within the athletic training program (for example first year versus fourth year) or if multiple previous experiences in the simulation lab would have an impact on perceptions of self-efficacy. This idea should be further explored in future studies.

It is important to note the increase of self-efficacy from immediately following the high fidelity simulation to a six month time was expected for both groups. Previous literature explains that in highly critical events such as emergency cardiovascular care, emotions and stress can influence actions and reactions (Scherer et al., 2003). It takes time to assimilate the actions and learning of this type of experience (Blum, Borglund, & Parcells, 2010). Therefore, a self-efficacy assessment immediately following an ECC high fidelity simulation will not fully reflect the true self-efficacy level achieved through participation in the experience.

Though it makes sense self-efficacy would increase over a short time following simulation, if the ECC skills are not performed in a clinical environment, eventually the self-efficacy of the athletic training student would plateau or decrease. Simply put, over time, and without opportunity for deliberate practice of this skill, participants will be less confident in their abilities to perform ECC skills in an actual clinical encounter. The current study provides evidence that perceived self-efficacy increases up to six months after a high fidelity simulation. However, future studies should explore where the peak of
self-efficacy appears and how long after six months post-simulation the perceptions of self-efficacy plateau or decrease.

The current study determined high fidelity simulation increased the self-efficacy of athletic training students related to their efficiency expectations on perceptions of ability to perform tasks within responding to a cardiac emergency. However, it did not compare that increase to low fidelity simulation which is currently used for training. Since the low fidelity equipment is designed to provide learners with a mode of practicing CPR tasks such as chest compressions and delivering a breath, it would be interesting to investigate in future studies if there was a difference in self-efficacy for task-related expectations between low and high fidelity simulation.

Future studies should also assess the self-regulatory component of efficacy expectations within self-efficacy. The high fidelity technology allows for programmable responses that would provide learners with challenges to cope with during the simulation. For example, it is taught if a respondent delivers too forceful of a breath into a cardiac victim, they will vomit because the breath is actually traveling into the stomach. The high fidelity mannequin has the technology to simulate vomiting and then the victim to aspirate (or choke) on their own vomit. It would be interesting to investigate the critical thinking piece of self-efficacy related to these self-regulatory components that determine how long they will persist with their behavior and how they will cope with efforts once they initiate care and there are challenges.

The current study provides evidence that there is no difference in self-efficacy gains between athletic training students who participate in a high fidelity simulation and those that observe one a simulation; both groups’ self-efficacy increases. The observation
group in the current study was standing at the side of the room directly watching the participation group. However, there are more ways to gain observation experience. For example, the simulations could be video recorded and then played for a group to watch. Future studies should investigate if there are differences in the self-efficacy of those that observe in-person scenarios such as the current study design verses observation of video demonstrations.

Additionally, this study was based on the theory that self-efficacy facilitates knowledge and clinical performance. Now that it has been established that high fidelity simulation increases the perceived self-efficacy of athletic training students, future research should investigate effects on knowledge and performance of CPR skills. Replicating the study with the examination of clinical competence for the participant’s skills may provide information concerning the degree to which self-efficacy effects performance. Though self-efficacy mediates clinical performance, confidence is not the same as effective performance, and therefore a study that measures both would be a valuable contribution to the literature.

The current study utilized a pretest-posttest design. Replicating the study utilizing an independent, randomly selected control group who does not participate in or observe a high fidelity simulation would minimize the internal validity threats of the current study and improve the strength of the study findings. The control group could either have no participation in a simulation, or they could use the same CPR scenario but perform the simulation on a low fidelity task trainer.

Finally, much of the previous literature cited measured self-efficacy over a one year time period (Madden, 2006; Scalese, et al, 2008). Future studies such include
additional longitudinal measurements to include one year so a determination may be made about how long the gains in self-efficacy may be expected in athletic training students who participate in a high fidelity simulation.

**Implications for Leadership Theory and Practice**

One of the most significant evolutionary trends in healthcare over the few decades is the shift from hierarchy management to transformational leadership (Trofino, 1995). Leadership theorist James Burns (1978) defines transformational leadership as “a relationship of mutual stimulation and elevation that converts followers into leaders and may convert leaders into moral agents” (p. 12) Patient driven outcomes is as the forefront of this trend, shifting focus to the responsibility of each health care provider within the system to become a technical expert and perform at a level necessary to deliver high-quality services to in a competent nature to all patients. Work has shifted to focused healthcare team approaches to patient care with each team member having the individual responsibility to be knowledge experts within their discipline and provide quality care (Trofino, 1995).

Transformational leadership has been linked to high levels of effort (Leban & Zulauf, 2004), confidence (Podsakoff, MacKenzie, Moorman, & Fetter, 1990) and exceptional levels of performance (Yammarino & Bass, 1990). These variables are all relevant to outcomes in medical and health care training because the way in which these future health care professionals perform will have an impact on their patients. Transformational leadership is a process of creating and sustaining a common vision in accordance with shared values for the community in which leaders and followers serve (Trofino, 1995). Within healthcare settings, that community is the patients.
Transformational leadership within today’s healthcare system with emphasis on patient outcomes demands formal educational programs emphasize the development of clinically competent providers. This includes providing students with deliberate practice opportunities within their educational programs so that they have opportunities to develop self-efficacy and clinical proficiency for skills they would be expected to perform in a healthcare setting. The primary role of healthcare providers to include athletic trainers in the changing healthcare environment is to empower others to be their own leaders (Trofino, 1995). Athletic training students must have the self-efficacy and clinical competence as newly certified healthcare providers to take on this challenge. It is the responsibility of the formal educational program to provide those opportunities. The current study demonstrates that an effective mode of increasing self-efficacy of athletic training students related to cardiovascular emergency skills is integration of high fidelity simulation into their formal educational program.

**Summary of the Study**

The aim of this study was to design an evidence-based solution to provide deliberate practice opportunities to athletic training students that would result in increased perceived self-efficacy relating to emergency cardiovascular care. This was achieved through providing athletic training students with an opportunity to participate in or observe a high fidelity cardiovascular emergency simulation scenario. Through a quantitative quasi experimental study design, it was found that both participation in and observation of a high fidelity simulation significantly increases the self-efficacy of athletic training students from prior to and immediately following simulation. Additionally, there was a significant increase in perceived self-efficacy of athletic
training students 6-months after completion of a high fidelity CPR simulation. It can be concluded that high fidelity simulation has a significant positive effect on self-efficacy over time for athletic training students.

Based on the results of this study, it is recommended that when feasible, annual high fidelity cardiovascular emergency simulation be incorporated into professional athletic training programs. This proposed solution should be implemented into professional athletic training programs through a series of eight steps; 1) developing a vision; 2) creating a business plan; 3) seeking buy-in from funding sources and executive leadership; 4) constructing the facility and purchasing equipment; 5) equipment training; 6) developing the curricula; 7) faculty development; and 8) determining policies and procedures. The leader should heavily consider the five elements of Rogers (2003) diffusion of innovation theory; relative advantage, compatibility, complexity, trialability, and observability, throughout the implementation of the eight steps to reduce barriers and increase the chances of success.

The current study demonstrated that the self-efficacy of athletic training students related to cardiovascular emergency skills improves after high fidelity simulation. Self-efficacy facilitates knowledge and clinical performance (Murphy & Kraft, 1993). If an athletic training student lacks self-efficacy for cardiovascular emergency management, it would be of concern that an athletic training student may not apply certain skills or hesitate before providing treatment because they lack the self-efficacy for cardiovascular emergency management. This could adversely affect patient outcomes. It is evident through the outcomes of the current study that the use of this educational tool is an
effective method of providing deliberate practice opportunities for athletic training students to improve their skill and increase self-efficacy related to CPR techniques.
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Appendix A

Emergency Cardiovascular Care Appraisal Inventory

Directions: A number of situations are described below that contribute to the management of a cardiovascular emergency. Please rate your degree of confidence with performing each statement listed below by circling a number from 0 to 10 using the following scale.

0  1  2  3  4  5  6  7  8  9  10
Cannot do at all  Moderately can do  Highly certain can do

1. Recognize the factors associated with cardiovascular emergencies.
   0  1  2  3  4  5  6  7  8  9  10

2. Complete an initial assessment within 15 seconds of arriving on the scene of an emergency.
   0  1  2  3  4  5  6  7  8  9  10

3. Accurately assess breathing and circulation of an unresponsive victim.
   0  1  2  3  4  5  6  7  8  9  10

4. Activate the emergency medical system (EMS) in an appropriate amount of time.
   0  1  2  3  4  5  6  7  8  9  10

5. Determine what treatment (compressions, clear airway, etc.) needs to be done based on initial assessment.
   0  1  2  3  4  5  6  7  8  9  10

6. Establish an airway on an unresponsive victim.
   0  1  2  3  4  5  6  7  8  9  10

7. Maintain an airway on an unresponsive victim.
   0  1  2  3  4  5  6  7  8  9  10

8. Provide a full seal and correctly use a barrier device to deliver breaths to a victim.
   0  1  2  3  4  5  6  7  8  9  10

9. Administer adequate ventilations using a barrier device at a volume and rate necessary to fill lungs.
   0  1  2  3  4  5  6  7  8  9  10

10. Administer chest compressions at a depth necessary to circulate blood.
    0  1  2  3  4  5  6  7  8  9  10
11. Administer chest compressions at a rate necessary to maintain adequate blood circulation.

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

12. Provide continuous and adequate compression/ventilations for a sustained time without a gap in care.

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

13. Perform 2-person cardiopulmonary resuscitation (CPR).

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

14. Expose patient’s chest and apply automated external defibrillator (AED) pads.

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

15. Deliver a shock using an AED.

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

16. Communicate with another provider to deliver emergency cardiovascular care during 2-person CPR.

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

17. Re-check vital signs after 5 cycles/two minutes of CPR.

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

18. Efficiently switch compressions/ventilations during 2-person CPR without a gap in care.

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

19. Communicate the victim’s history with a responding EMS team.

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

20. Successful manage an entire cardiovascular emergency scenario.

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
Appendix B

Please note that Creighton University IRB-02 Social Behavioral has taken the following action on IRBNet:

Project Title: [892693-1] The Effects of Emergency Cardiovascular Care High Fidelity Simulation on Athletic Training Students' Perceived Self-Efficacy
Principal Investigator: Kristin Tivener, MET, ATC

Submission Type: New Project
Date Submitted: April 6, 2016

Action: EXEMPT
Effective Date: April 6, 2016
Review Type: Exempt Review

Should you have any questions you may contact Christine Scheuring at christinescheuring@creighton.edu.

Thank you,
The IRBNet Support Team

www.irbnet.org
Appendix C

To:
Kristin Tivener
Sports Med & Athl Training

Approval Date: Aug 25, 2015
Expiration Date: Aug 24, 2016

RE: Notice of IRB Approval
Submission Type: Initial
Study #: IRB-FY2016-53
Study Title: The Effect of Simulation on Athletic Training Students’ Perceived Self-Efficacy
Decision: Approved

This submission has been approved by the Missouri State University Institutional Review Board (IRB) for the period indicated.

Federal regulations require that all research be reviewed at least annually. It is the Principal Investigator’s responsibility to submit for renewal and obtain approval before the expiration date. You may not continue any research activity beyond the expiration date without IRB approval. Failure to receive approval for continuation before the expiration date will result in automatic termination of the approval for this study on the expiration date.

You are required to obtain IRB approval for any changes to any aspect of this study before they can be implemented. Should any adverse event or unanticipated problem involving risks to subjects or others occur it must be reported immediately to the IRB.

This study was reviewed in accordance with federal regulations governing human subjects research, including those found at 45 CFR 46 (Common Rule), 45 CFR 164 (HIPAA), 21 CFR 50 & 56 (FDA), and 40 CFR 26 (EPA), where applicable.
Appendix D

Creighton University

Consent to Participate in a Research Study
Creighton University
Interdisciplinary Education Doctoral Program in Leadership
The Effects of Emergency Cardiovascular Care High Fidelity Simulation on Athletic Training Students’ Perceived Self-Efficacy
Kristin Tivener, MET, ATC/L

Introduction
You have been asked to participate in a research study. Before you agree to participate in this study, it is important that you read and understand the following explanation of the study and the procedures involved. The investigator will also explain the project to you in detail. If you have any questions about the study or your role in it, be sure to ask the investigator. If you have more questions later, Kristin Tivener, the person mainly responsible for this study, will answer them for you. You may contact the investigator(s) at:

KTivener@MissouriState.edu

Office location at Professional Building Room 160B

You will need to sign this form giving us your permission to be involved in the study. Taking part in this study is completely voluntary. If you decide to take part but later change your mind, you may stop at any time. If you decide to stop, you do not have to give a reason and there will be no negative consequences for ending your participation. Your course grade will not be affected by your non-participation.

Purpose of this Study
Given that levels of perceived self-efficacy is malleable as well as the opportunities high fidelity simulation can provide, the purpose of this study is to examine the difference in self-efficacy scores of undergraduate athletic training students prior to and following participation in a high fidelity simulated cardiovascular emergency scenario using the Laerdal® SimMan in a university simulation center in the United States. There will be approximately 50 total participants in this study.

Description of Procedures
If you agree to be part of this study, you will be asked to either participate in or observe a simulation then complete a pretest and posttest survey. The total time of your involvement in this study will be between 1-1 ½ hours. Your answers to these surveys and your participation in this study will in no way impact or affect your grade in athletic
training courses. The questions in the pre and posttests will relate to your confidence
CPR.

**What are the risks?**

There is no to minimal physical, psychological, and/or social risks for participating in the
research. There will be no detrimental effects to your course grades if you choose not to
participate in this study.

**What are the benefits?**

There may be no direct benefit from participating in this study. This study will provide
information for the improvement of subsequent simulations for other students.
Understanding the self-efficacy and experiences of students during this simulation will
allow the researchers to further improve the simulation experience and training for CPR
for subsequent students.

**How will my privacy be protected?**

The results of this study are confidential and only the investigators will have access to the
information which will be kept in a locked cabinet at the University. All data results will
be presented in aggregate form. Your name or personal identifying information will not
be used in any published reports or presentations of this research. All information
gathered during this study will be destroyed 2 years after the completion of the project.

**Consent to Participate**

If you want to participate in this study, The Effects of Emergency Cardiovascular Care
High Fidelity Simulation on Athletic Training Students’ Perceived Self-Efficacy you will
be asked to sign below:

I have read and understand the information in this form. I have been encouraged to ask
questions and all of my questions have been answered to my satisfaction. By signing this
form, I agree voluntarily to participate in this study. I know that I can withdraw from the
study at any time. I have received a copy of this form for my own records.

________________________________________  ______________________
Signature of Participant                              Date

________________________________________
Printed Name of Participant

________________________________________  ______________________
Signature of Person Obtaining Consent                     Date
Appendix E

Demographic Information

ID # ____________

1. Gender (circle one)  Male  Female

2. Year in AT program:  First  Second  Third  Fourth

3. Age _____________

4. How many years have you been CPR certified? _____________

5. Have you ever held a lifeguard, EMT, or other response team certification? 
   __________

6. Have you ever been a part of a real-life cardiac emergency experience where you 
   had to do chest compressions, breaths, etc.?  Yes  No

7. Have you participated in or observed a CPR simulation within the past year (using 
   the high-fidelity mannequins)?  Yes  No
Simulation Learning Objectives:
- Demonstrate appropriate CPR and lifesaving techniques with patients.
- Provide safe environment for students to process fears about death and dying.

<table>
<thead>
<tr>
<th>Manikin Requested</th>
<th>Thomas</th>
</tr>
</thead>
<tbody>
<tr>
<td>OCHC SIM ROOM 2</td>
<td></td>
</tr>
</tbody>
</table>

Simulation Scenario Part 1 (Backgrounds):
Scenario A: You are an ATC at a high school working a junior varsity football game. One of the linemen takes a hard hit to the side and comes off the field holding his side and collapses near you on the sideline.

Scenario B: You are a collegiate ATC and you are walking down onto the soccer field to set up for practice. As you are walking through the tunnel with your students, you all notice someone lying face down on the track. The person is not moving and there is no one else on the track.

Simulation Scenario Part 2 (Scenario Progression):
Scenario A:
<table>
<thead>
<tr>
<th>The simulator presents with: (the trigger event)</th>
<th>Which prompts the student to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unconscious victim lying prone (take mannequin Thomas out from bed and place on floor. Will also bring t-shirt and athletic shorts to change before scenario from hospital gown.)</td>
<td>Primary assessment of scene, Look, Listen, Feel Activate EMS Call for AED</td>
</tr>
<tr>
<td>No Pulse</td>
<td>Begin CPR; Establish airway (head tilt or OPA,NPA)</td>
</tr>
<tr>
<td>No Respiration</td>
<td>Chest compressions, continue with CPR cycles.</td>
</tr>
<tr>
<td>No Vital Signs</td>
<td>Place pads and “shock” with AED</td>
</tr>
<tr>
<td>2 rescue breaths “go in”, chest rises</td>
<td>Continue CPR and AED</td>
</tr>
<tr>
<td>AED arrives</td>
<td>Continue CPR and give history</td>
</tr>
<tr>
<td><strong>Alternative Scene set ups…Using corn, simulate vomit on Thomas prior to beginning</strong></td>
<td>Check for airway obstruction, clean vomit from inside mouth.</td>
</tr>
</tbody>
</table>

Scenario B:
<table>
<thead>
<tr>
<th>The simulator presents with: (the trigger event)</th>
<th>Which prompts the student to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unconscious victim in sidelying position (take mannequin Thomas out from bed and place on floor. Will also bring t-shirt and athletic shorts to change before scenario from hospital gown.)</td>
<td>Primary assessment of scene, Look, Listen, and Feel Activate EMS Call for AED</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>No Pulse No Respiration No Vital Signs</td>
<td>Begin CPR Establish airway (head tilt or OPA,NPA)</td>
</tr>
<tr>
<td>Breaths do not “go in”</td>
<td>Re-tilt head/reestablish airway</td>
</tr>
<tr>
<td>Chest rises with 2 breaths</td>
<td>Continue with chest compressions/CPR cycle</td>
</tr>
<tr>
<td>AED arrives</td>
<td>Place pads and “shock” with AED Recheck victim for vital signs</td>
</tr>
<tr>
<td>Pulse felt (irregular), no respiration</td>
<td>Continue CPR Administer another “shock” with AED Recheck victim for vital signs</td>
</tr>
<tr>
<td>Pulse (regular = 60, Respiration = 10)</td>
<td>Continue to monitor with AED</td>
</tr>
<tr>
<td>“EMS” arrives</td>
<td>Give history</td>
</tr>
<tr>
<td>**Alternative scene set ups…Different initial position – Supine? **</td>
<td></td>
</tr>
</tbody>
</table>
Appendix G

Mid-America Athletic Trainers’ Association
Research and Education Committee

Grant Application

(This must be the first page of the application. Will be seen by committee chair only)

TITLE OF PROJECT: The Effect of Simulation on AT Students’ Perceived Self-Efficacy

PRINCIPAL INVESTIGATOR: Tivener Kristin Ann

LAST NAME FIRST NAME

MIDDLE

OTHER INVESTIGATORS: N/A

INSTITUTION OF PRINCIPLE INVESTIGATOR: Missouri State University

ADDRESS: 901 South National Avenue

CITY: Springfield STATE: MO ZIP: 65897

PHONE: (417) 836-3795

DEPARTMENT: Sports Medicine Athletic Training

ADDRESS: 901 South National Avenue, Professional Building Room 160

CITY: Springfield STATE: MO ZIP: 65897

E-MAIL ADDRESS: KTivener@MissouriState.edu

NATA MEMBERSHIP #: 994410 NATA CERT #: 080402383

CATEGORY FOR CONSIDERATION (Check one)

___ Basic Science ___ Sports Injury/epidemiology ___ Clinical Studies

___ Educational Research ___ Observational/Informational Studies

STATUS OF THE PROJECT

New project X ___ Continuing program_____ Follow-up Study_____

(Include explanation) (Include explanation)

ESTIMATED COST OF PROJECT COMPLETION: $1000

AMOUNT REQUESTED FROM MAATA: ___ $2000 ___ $1500 ___ $1000 ___ $500
Typed summary of research/project objectives: this section (500 WORDS OR LESS) must explain what is to be done and its practical application to the field of Athletic Training. Please include a brief description of your background (and/or mentor) and the facilities/resources that are available to complete this study.

Project Title: The Effect of Simulation on AT Students’ Perceived Self-Efficacy

Description of Study:
The purpose of this quantitative experimental study is to investigate the effect that an emergency cardiovascular care high fidelity simulation has on the perceived self-efficacy of athletic training students.

Participants will be randomly selected into two groups; one group containing participants who will actively contribute to the scenario and the other group containing participants who will observe their peers contributing to the scenario. The examination of these two groups is important to this study because it is hoped to identify whether performance attainment or vicarious experiences are factors contributing to significant differences in self-efficacy.

The second part of the study will separate participants into two groups; those that have previously completed a high fidelity cardiovascular simulation within one year and those that have not. The examination of previous experience is important to this study because it is hoped to identify the length of time following a simulation where possible self-efficacy outcomes are retained.

Self-efficacy is defined as “people’s judgements of their capability to organize and execute the courses of action required to attain designated types of performances” (Bandura, 1986, p.391). Therefore, the central question for this study is: What is the difference in self-efficacy scores of athletic training students prior to and following participation in a high fidelity cardiovascular emergency scenario utilizing the Laerdal® 3G SimMan?

Significance:
Over the past two decades, simulation technology as a teaching and training method has been increasingly incorporated into educational and training in medical and health programs (Rosen, 2008). Participants in simulation can improve clinical performance through repeated practice of an appropriate response to a specific clinical situation through a simulated scenario (Laster, 2007). This becomes especially important for individuals trying to improve clinical performance with skills that involve low incidence, or rarely occurring, high risk clinical events. Within athletic training, cardiovascular emergencies are considered high risk, low incident encounters. The clinical performance for the management of cardiovascular emergencies is of concern to ATs and ATSs.
General agreement among educators is that success in clinical practice is not only dependent on educational training, but also includes nonacademic factors such as self-efficacy that influence performance (Opaic, 2003). Bandura (1977) describes that a relationship has been established between self-efficacy and successful performance. Simply put, enhanced self-efficacy translates to an increased confidence to apply skills in a real clinical situation.

Despite the increased use of simulation in medical and health care programs, there is limited research on its application in athletic training education. This gap in literature prompted the design of this original research study to explore the effects on perceived self-efficacy of athletic training participants in a high fidelity simulation involving emergency cardiovascular care skills.

References:


Researcher’s Background:

The researcher is a certified athletic trainer that has maintained Professional Rescuer CPR certification throughout their career, is certified to teach Emergency Cardiovascular Care (ECC) courses taught by the American Academy of Orthopedic Surgeons and the American College of Emergency Physicians, has attended multiple professional development activates related to emergency cardiovascular care, and stays current on the literature and development of this topic. Additionally, the researcher has taught this material in a CAATE approved professional AT program for 3 years and has several peer-reviewed publications in the area of high-fidelity simulation. This study was designed as part of a dissertation in practice for the researchers’ Ed.D doctoral studies.

Facility/Resources Available:

The researcher is completing their doctoral studies at a different institution from the institution in which they are employed as a faculty member. The home department the
researcher is employed at a simulation center equipped with Laerdal® 3G SimMan hardware and software. As a faculty member, they will have full access and usage of the universities’ simulation center.

BUDGET: This section should include the complete budget for the overall project.

Total

1. Surveys
2. Mailings or postage
3. Perishable materials (list)
4. Consultants (itemize)
5. Subjects
6. Hardware/Capitol goods (list)
   (1) Zoll AED Training Unit $382.46
   (5) Four-pack cotton t-shirts ($17.36 ea) $86.80
   (2) 12-pack scrimmage jersey ($14.99 ea) $29.98
   (2) Zoll AED replacement pads ($139.07 ea) $278.14
   (1) Zoll AED Soft Case $96.04
   (10) CPR masks ($12.65 ea) $126.50

Hardware/Capitol Goods Total $999.92
7. Other (list)
TOTAL $999.92

Amount requested: ___ $2000 ___ $1500 _X_ $1000 ___ $500

Research Plan or Project Outline including: Purpose, Methods, Statistical analysis, Budget rational (include description of ability to complete project with partial funding), and Time Schedule. (1000 WORDS OR LESS)

Purpose of Study:
Given that levels of perceived self-efficacy are malleable as well as the opportunities high fidelity simulation can provide, the purpose of this study was to examine the difference in self-efficacy scores of undergraduate athletic training students prior to and following participation in a high fidelity simulated cardiovascular emergency scenario using the Laerdal® 3G SimMan in a University simulation center in the United States.

Methods:
The proposed study will use a convenience sample of 40-60 undergraduate athletic training students recruited from a CAATE-accredited program in the Midwest. This study was granted IRB approval in October, 2015. After being randomly assigned to either a participation or observation group, all participants in both groups will complete the Emergency Cardiovascular Care Appraisal Inventory (ECCAI) survey which will serve as the pretest self-efficacy score (Appendix A). The ECCAI was developed for this dissertation in practice for the purpose of measuring perceived self-efficacy scores related to actions occurring in a cardiovascular emergency.

Next, based on their group assignment, they will either participate in or observe a high fidelity emergency cardiovascular simulation using the Laerdal® 3G SimMan in the universities’ simulation center. Immediately following the simulation, all participants (participation and observation group) will complete the ECCAI survey which will serve as the posttest self-efficacy score in this form of repeated measures study design. In addition to demographic information to include age, gender, length of time ECC certified, and prior experience with real-life cardiovascular emergencies, participants will be asked if they have had previous experience with participation in high fidelity cardiovascular simulation within the past one year. Response to this question will be used after data collection to analyze effects on self-efficacy scores based on previous simulation experience.

**Statistical analysis:**
Perceived self-efficacy in performing emergency cardiovascular care will be measured with the ECCAI survey instrument on a 10-point Likert scale (Appendix A). The same instrument will be used for both pre- and post- measurements.

The ECCAI survey was developed as part of the study/dissertation in practice for the purpose of measuring self-efficacy. Questions were examined for face validity by a panel of experts (n=6). Slight modifications were made based upon feedback. Using a 5-point Likert scale, a panel of experts (n=6) examined the questions for content validity responding to how useful and appropriate each question rated. Content validity index was calculated at 0.93. Using Lawshe’s (1975) CVI table with a level of significance set at p-value .05, the content validity was recorded as CV(6) = .800 P < .05 thus it can be judged as having excellent content validity.

Reliability of questions in the ECCAI survey instrument was determined by utilizing a pre-post design and paired sample correlations in a sample of undergraduate athletic training students (n=25). Cronbach’s alpha was calculated at the value of 0.96 which suggests the instrument is highly reliable.

The proposed study would use a pretest-posttest quantitative design to evaluate the effects of a high fidelity cardiovascular emergency simulation on athletic training students’ self-efficacy scores. To answer the research questions, a within-subjects design will be used to compare scores from the pre- and post- ECCAI survey using repeated measures ANOVA in SPSS software (Version 17.0, IBM, Inc.). Significance will be set at p < .05.
**Reference:**

**Budget Rational:**
The researcher is requesting $1000 from the MAATA Research Grant to purchase an AED training unit ($382.46) along with supplemental AED equipment to include AED replacement pads ($139.07 each), CPR barrier devices ($12.65 each) and an AED soft case ($96.04). The cotton t-shirts (4-pack $15.88) and jerseys (12-pack $14.99) are requested to dress the mannequin so that the fidelity (or realism) of the simulation scenario is increased. As part of simulation, students will need to cut the shirt/jersey off of the victim in order to expose the chest to correctly place the AED unit.

**Time Schedule:**
- Grant Submission: December 2015
- Recruiting subjects: August 2016
- Data Collection: Aug.-December 2016
- Analysis/ write-up: Jan.-March 2017
- Results presented for Dissertation Defense: May 2017
- Results presented MAATA District V Symposium: March 2018
- Application for Free Communications Presentation for NATA Symposium: June 2018