

The Relationship Between the Level of Athletic Training Education and
Critical Thinking Skill

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Abstract

Critical thinking has been identified as an essential skill for athletic training and has been extensively studied in other allied health and medical education programs such as nursing, dentistry, and physical therapy. However, little is known about critical thinking in the health profession of athletic training. In addition, currently there are two separate routes to athletic training certification. No research has been done comparing critical thinking in undergraduate versus graduate level athletic training students.

The intent of this study was to determine if a difference exists in students' critical thinking skill between undergraduate and entry level master athletic training students. A mixed methods design was employed for this investigation. Quantitatively the California Critical Thinking Skills Test (CCTST) was utilized to assess critical thinking skills in both undergraduate and entry level master athletic training students. A sample of 174 students from 20 different athletic training accredited institutions were invited to participate.

All students sampled were expected to be graduating within one year from their participation and eligible to sit for the BOC examination. Carnegie classification was utilized to match the ten undergraduate and ten entry level master programs. Qualitatively the participants answered open ended questions regarding their perception of critical thinking.

Data were entered into SPSS 18 and analyzed for measures of central tendency as well as a MANOVA do determine if a difference existed between the two groups. To analyze the open ended questions, responses were placed into

themes. Findings of the statistical analysis revealed no statistical difference between both groups in critical thinking skill or the subscale. In addition critical thinking skill had no relationship between demographic variables of age, ethnicity or gender in both groups of students. Several findings emerged from the qualitative analysis. Due to the complex nature of the conception of critical thinking and the large volume of critical thinking research in other educational domains, the researcher suggests further investigation specific to athletic training education be undertaken.

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CHAPTER I

Introduction

Athletic training underwent a major educational reform beginning in the early 1990's. Although there have been significant changes in athletic training education, there appears to be a considerable lag in the area of critical thinking research compared to other allied and medical healthcare professions. Fuller (1997) advocated for the development of specific critical thinking (CT) skills as part of the curriculum in athletic training education. Since this statement was made over ten years ago, there has been limited published research regarding critical thinking in athletic training education. The development of critical thinking skills in students enrolled in allied health has been a major emphasis of those programs (Fuller, 1997).

Critical Thinking is a focus at every level of education: elementary, secondary and higher education (Duron, 2006 & Halpern, 1993). In 1994 Congress enacted "Goals 2000: Educate America Act" identifying national educational goals. Goals 2000 clearly mandated college graduates be able to demonstrate an advanced ability to think critically. This directive signified the emphasis Congress has placed on the importance of students' ability to critical thinking in higher education. Heinrichs (2002) communicated the growing challenge for professional educational programs like athletic training education to produce professionals who are capable of thinking critically, who can sequentially analyze and solve dynamic problems, who can rapidly take the information at

hand and make critical decisions (p.189). Athletic training is an allied health profession that demands those capabilities.

Critical thinking has been viewed as being so essential for future health care providers that the National League of Nursing has mandated nursing curricula include critical thinking (Fuller, 1997). Nursing students today are expected to have competence in critical thinking (Stewart & Dempsey, 2005). Athletic training is an allied health field similar to nursing that requires its practitioners to have a high level of critical thinking. Accreditation standards for entry-level programs in physical therapy, occupational therapy, and nursing are intended to produce health care professionals capable of thinking critically and are specifically addressed in their curriculum standards. Athletic Training Education is a relatively new area of academia and much of its curriculum theory has been borrowed from nursing.

Presently there are two routes to become a certified athletic trainer. One must graduate from a CAATE accredited athletic training curriculum which is currently offered at either a bachelors or entry level masters level. At the completion of their formal training and graduation from one of those two types of programs, students must successfully complete a comprehensive exam administered by the Board of Certification (BOC). Many educational leaders within the field of athletic training education are advocating for an elimination of the bachelors level for eligibility to sit for the BOC exam. Dissolution of the bachelor route would leave the master's level as the single route to becoming a certified athletic trainer. What is not known is if there is a difference in critical

thinking ability between the graduate and undergraduate students taking the same comprehensive exam in preparing for their professional career in athletic training.

Currently there are no studies published exploring relationships between entry-level masters and bachelor levels of athletic training education. Studies focusing on comparisons between undergraduate and post-professional graduate programs exist but are not relevant. Post-professional students have already taken and passed the BOC exam and, therefore, have experienced similar undergraduate education. In addition no studies were found analyzing critical thinking between different levels of athletic training education.

Problem Statement

Critical thinking has been identified as an essential skill for athletic training and has been extensively studied in other allied health and medical education programs such as nursing, dentistry, and physical therapy. Critical thinking has been incorporated in the educational standards and outcomes of those allied health education programs (Colucciello, 1997; Howenstein, Bilodeau, Brogna & Good, 1996). However very little is known about critical thinking, in the allied health field of athletic training (Fuller, 1997; Leaver-Dunn Harrelson, Martin, & Wyatt, 2002; Swiger, 2005; Walker 2003). Athletic training education programs have placed more emphasis on critical thinking within its curriculum construction within the last ten years (Swiger, 2005). However, the literature is minuscule. In addition, currently, there are two separate routes to athletic training certification. There is debate within the profession about the elimination of the undergraduate

route and mandating a masters as the only route to certification. No research has been done comparing critical thinking in undergraduate versus graduate level athletic training students. Bartlett and Cox (2002) suggested a difference could emerge between allied health care practitioners trained at an undergraduate versus graduate program.

Purpose of the Study

The purpose of the study was to add to the debate as to whether athletic training students should be formally trained at the undergraduate or graduate level based on exploration of their critical thinking skill. In order for this it was imperative to determine if a relationship exists between athletic training student's current level of education and their measured ability to critically think. In addition this investigation explored athletic training student's perception of what factors or characteristics of their clinical education influenced their critical thinking skill.

Research Questions

- RQ1. Is there a difference in critical thinking skills between students graduating from an entry-level master's athletic training education program and students graduating from an undergraduate athletic training education program?
- RQ2. What are the components of athletic training clinical education that an athletic training student recognizes or perceives as helpful in increasing their critical thinking skill in both undergraduate and graduate level students?

Rationale

It is clear critical thinking is an important skill to foster in higher education (Brock & Butts 1998; Daly 1998; Daly 2001; Duron Limbach & Waugh, 2006; Cise, Wilson & Thie, 2004; de Sanchez 1995; Giancarlo & Facione, 2001;

Halpern, 2001; Leaver-Dunn, Harrelson, Martin & Wyatt 2002; Walker, 2003). In addition critical thinking is highly sought after in allied health professionals and has been advocated by many to be purposefully taught in allied health education programs (Allen 2004; Bartlett & Cox 2002 Fuller 1997; Chau, Chang, Lee, Ip, Lee & Wotten 2001; Leaver-Dunn, Harrelson, Martin & Wyatt 2002; Simpson & Courtney, 2002).

The California Critical Thinking Skills Test (CCTST) has been found most frequently in the Allied Health Education literature to evaluate CT skills (Allen 2004; Beckie, Lowery & Barnett, 2001; Bartlett & Cox 2002; Behar-Horenstein, Dolan, Courts & Mitchell, 2000; Chau, Chang, Lee, Ip, Lee & Wotten 2001; Colucciello, 1997; Daly 1998; Duchscher, 1999; Giancarlo & Facione, 2001; Leaver-Dunn, Harrelson, Martin & Wyatt 2002; Walker 2003). The CCTST reflects critical thinking ability in Allied Health the most accurately (Adams, Stover & Whitlow, 1999).

There is a lack of research exploring the different elements that athletic training students are exposed to in their clinical education and how those variables may influence critical thinking skills. Therefore, this study determined if a difference exists in critical thinking skills in students enrolled in the two different routes to athletic training certification. The rationale for this investigation was to gather information regarding critical thinking skills of both undergraduate as well as graduate students. If a significant difference was found between the critical thinking skills of undergraduate and graduate students, a stronger case may be made for transitioning to a single route to certification. In addition, if critical

thinking skills scores in athletic training students are significantly low, athletic training educators may want to change their pedagogical practices to help foster these skills. In addition, there are implications of thinking critically in athletic training within the competency approach, especially in the area of clinical education. Uncovering, what the students' perceptions of factors influencing their ability to critically think in a clinical education could affect future program and development of athletic training clinical education standards, curriculum development and instructional strategies.

Operational Definition of Key Terms

Athletic Training - Athletic training is practiced by health care professionals who collaborate with physicians to optimize activity and participation of patients and clients. Athletic training encompasses the prevention, diagnosis, and intervention of emergency, acute, and chronic medical conditions involving impairment, functional limitations, and disabilities (NATA, 2011).

Athletic Training Profession – An Allied Health field recognized by the American Medical Association (AMA).

Athletic Training Student (ATS) - A student enrolled in the athletic training major or graduate major equivalent (CAATE Accreditation Guidelines, 2008).

Board of Certification (BOC) – An independent non-profit corporation responsible for the certification of entry-level athletic trainers and establishment of requirements for maintaining the status as a certified athletic trainer (BOC Retrieved December 12, 2011).

Certified Athletic Trainer (ATC) - Unique health care providers who specialize in the prevention, assessment, treatment and rehabilitation of injuries and illnesses (NATA, 2011).

Clinical Education - The application of knowledge and skills, learned in classroom and laboratory settings, to actual practice on patients under the supervision of a Preceptor (CAATE Accreditation Guidelines, 2008).

Clinical Experience - Those clinical education experiences for the Athletic Training Student that involve patient care and the application of athletic training skills under the supervision of a qualified instructor (CAATE Accreditation Guidelines, 2008).

Clinical Rotation – A specific guided clinical experience supervised by an ACI for the athletic training student. This educational experience/rotation can occur at a college, university, high school, clinic, or professional sports environment.

Clinical Supervision – A supervised clinical experience occurs when a program Approved Clinical Instructor (ACI) is physically present and can intervene on behalf of the athletic or patient. The ACI must maintain both auditory and visual contact with the students.

Commission on Accreditation of Athletic Training Education (CAATE) – The agency responsible for the accreditation of over 350 professional (entry-level) athletic training educational programs. The commission provides comprehensive accreditation services to institutions that offer athletic training degree programs and verifies all accredited programs meet the acceptable educational standards

for professional (entry-level) athletic training education (BOC, Retrieved December 12, 2011).

Critical Thinking - Self-regulatory judgment which results in interpretation, analysis, evaluation, and inference as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based (Facione, 1990, p. 2).

Executive Committee on Education (ECE) – The council serves as the NATA’s voice in matters related to athletic training education. It facilitates continuous quality improvements in entry-level, graduate, and continuing athletic training education (NATAEC, Retrieved December 20, 2011).

National Athletic Trainers Association (NATA) – Professional, governing organization for the athletic training profession.

Preceptor - An appropriately credentialed professional identified and trained by the program clinical instructor educator, to provide instruction and evaluation of the Athletic Training Educational Competencies and/or Clinical Proficiencies. Preceptors may not be a current student within the athletic training education program.

CHAPTER II

Review of Literature

The purpose of this chapter is to provide an overview of the history of critical thinking, critical thinking in higher education and a review of common instruments utilized by allied health education programs. The literature review will also include different conceptualizations and definitions of critical thinking.

History of Critical Thinking

The roots of critical thinking can be traced back as far as Socrates, 399 BC (Daly, 1998). Although Socrates did not leave a literary legacy, he is well remembered for his application of the dialectical method requiring inquiry on the part of the participants in order to determine the plausibility of widely-held doctrines. The idea of questioning known truths is the foundation of today's construction and utilization of critical thinking (Daly, 1998, p. 324). Socrates lectured on the importance of truth exploration and questioning for meaning and justification of all claims (Paul, 1990). Socratic questioning is viewed by many as integral in developing critical thinking skills in students enrolled in higher education and even more important in allied health and medical education (Behar-Horenstein, Dolan, Courts, & Mitchell, 2000; Oermann, 1997; Walker, 2003).

Philosopher John Locke helped support the notion of critical inquiry. Locke published his *Essay Concerning Human Understanding*, in 1690 conveying a belief the human mind is a tabula rasa or blank slate. He emphasized the importance of mental discipline concentrating on ones own thoughts. Lockes

writing significantly influenced Benjamin Franklin who formed the American Philosophical society in 1743, which brought the European Enlightenment into colonial America and helped set a foundation of American education. This purposeful reliance in mental discipline is the foundation of liberal education in the United States.

Mental discipline took on a more pragmatic worldview from contributions of educational philosopher John Dewey. Dewey is credited as the *father of critical thinking* and actually coined the term *critical thinking* (Facione, Facione, Blohm, Giancarlo, 2002). He explained there were *attitudes* that one must possess and practice to be a critical thinker. The attitude of being open-minded, whole-hearted, and intellectually responsible, were all imperative for engaging in reflective thinking, and necessary for critical thinking (Dewey, 1933). In order for one to be open-minded the person must be free from prejudice and partisanship. Open-mindedness, according to Dewey, was ones willingness to discuss and listen to all perspectives of an issue and exhaust all possibilities, even if they do not match ones view. Dewey defined whole-heartedness as placing all of ones energy into learning something. Intellectually responsible, according to Dewey was to be whole-hearted when learning and thinking. These attitudes were to be strengthened by practice which Dewey referred to as *habit of mind* (Dewey, 1933, p.9).

Dewey (1933) constructed a critical thinking approach that was labeled the reflective thought model. The model included five specific stages: suggestions, problem, definition, hypothesis generation, reasoning, and hypothesis testing.

This reflective thinking model was intended to be an active process. Dewey conceptualized this activity on the part of the teacher and the students. Dewey continually advocated for the notion of every working man is a scholar and every scholar a working man. Others have utilized Dewey's original model as a starting point to develop new and similar models to his conceptualization.

Much of Dewey's writings were centered on creating a democratic society and education would be the driver in this transformational process. Mezirow shared this vision as he advocated for the importance of fostering democratic social change in adult education and the need for developing a truly democratic society. Mezirow (1989) suggested one cannot have a true democratic society without social justice. This would require the critical awareness of the present power structures within the group that have caused some voices to be silenced, thus not allowing for everyone to be equal. By being critically aware of these injustices and by questioning where power comes from, Mezirow considered this a move to creating a greater participation in democracy. Therefore, Mezirow believed for a society to be equal and democratic in nature, in which all have an equal voice, participants of society must be willing to question known truths.

Dewey felt it was critical to facilitate a reflective process with students in order to develop them both intellectually and morally (Daly, 1998). Critical reflection or examining the nature, consequences, and origin of an individual's meaning perspectives can lead to a transformation in the individual (Mezirow, 1995). Mezirow defined meaning perspectives as an individual's structure of assumptions from which they assimilate past experiences during the process of

interpreting new information. In order to progress in transformational process Mezirow advocated for critically examining assumptions. This is reflective of the work done by Brookfield and his admonishment for exploring paradigmatic assumptions. Brookfield (1995) stated critical reflection is paramount for educators to insure every student is respected, valued, and heard and is necessary to create democratic classrooms. This is accomplished by understanding the critical thinking process, i.e. the identification of assumptions one holds.

Brookfield (1995) believed it was critical when challenging ones assumptions to consider context, imagining and exploring alternatives, and utilizing information with reflective skepticism. Brookfield was writing about the individual classroom but Mezirow is taking that same exchange between teacher and students and applying it to adults in order for them to transform their perspectives. Mezirow's transformative learning occurs only then though critical self-reflection, when an individual revises old or develops new assumptions, beliefs, or ways of seeing the world (Cranton, 1994). Critical reflection or the examination of assumptions is the central component to critical thinking.

Garrison (1991) incorporated Dewey's work with Brookfield's model of critical thinking to conceptualize a five phase critical thinking model: identify a problem, define the problem, exploration, applicability, and integration. These stages are to be considered in a cyclical and recursive nature rather than in a linear fashion. Garrison wrote about the self-guided reflective cycle, i.e., students complete a portion of a problem and then receives new information; the cycle of

evaluation begins anew, thus presenting a new problem. The development of critical thinking is impacted by the student's ability to engage in critical reflection. Brookfield (1995) believes for the act of reflection to be considered critical the person must consider how *power* undergirds and distorts processes as well as to contemplate hegemonic assumptions. Critical reflection, that is, identifying assumptions, is important because it drives the ability for a person to gain a greater understanding of their own perception (Ford & Profetto-McGrath, 1994).

In the 1980's, a resurgence of the exploration of critical thinking in education occurred. This explosion of research was centered on the notion of critical thinking as being an integral component of the health and vitality of the United States. *A Nation at Risk* was published in 1983, which helped to drive this new national priority. The report was considered a wake up call for American educational systems and emphasized critical thinking as a national priority for both civic and economic reasons. Consequently, many scholars and educators began exploring and researching critical thinking. As a result, a focus on K-12 and post secondary education was the insertion of liberal education into the curriculum. Liberal education is the process of inquiry, learning and thinking rather than the rote memorization of disjointed, unusable information (Facione, 1990).

Dr. Richard Paul agreed that rote memorization of facts without specific utilization does not serve students well. Paul is the director of research and professional development at the Center for Critical Thinking and is a recognized authority on the subject. The Center for Critical Thinking is an educational non-

profit organization which works to promote educational reform to include critical thinking (Critical Thinking Community, 2012). Paul advocates for the active, and independent or self-directed approach to information gathering and construction led by the student and to do so critically (Paul, 1990). This paradigm shift is well supported in the literature (Brookfield, 1987; Duron et al., 2006; Paul, 1990; Profetto-McGrath, 2003).

Other events transpired more recently to support the need for increased examination of critical thinking. Nationally Congress enacted Goals 2000: Educate America Act which specifically lists critical thinking as an educational outcome (Facione, Sanchez, Facione & Gainen, 1995). At a state level, California instituted critical thinking as an educational requirement in all community colleges and state universities (Halpern, 1993). Critical thinking has been often listed as a desirable course outcome and is mentioned in many college course syllabi (Fuller, 1997). However, some individual disciplines are adding critical thinking to their accreditation standards. For example the National League for Nursing Accreditation Commission (NLNAC) has specified critical thinking skills in outcomes of students (Beckie, Lowry & Barnett, 2001; Cise, Wilson & Thie, 2004). As a result of this inclusion, the exploration of critical thinking in nursing is extensive (Colucciello, 1997; Stewart & Dempsey, 2005). However, investigation into critical thinking in athletic training educational programs is minimal (Fuller, 1997; Leaver-Dunn, Harrelson, Martin, & Wyatt, 2002; Swiger, 2005).

Critical Thinking Definitions / Conceptualizations

There have been many attempts to define and conceptualize critical thinking in the literature. The definitions and conceptualizations often lack consistency. Lack of uniformity in definition of critical thinking has been mentioned by many researchers in both nursing and allied health education (Adams, Stover & Whitlow 1999; Adams, Whitlow, Stover & Johnson, 1996; Allen 2004; Daly 2001; Cise, Wilson & Thie, 2004; Halpern, 2001; Leaver-Dunn, Harrelson, Martin & Wyatt 2002; Profetto-McGrath, 2003; Profetto-McGrath, Hesketh, Lang & Estabrooks, 2003). In nursing, medical, and allied health education it is extremely important to contextualize or provide an operational definition of critical thinking (Colucciello, 1997; Daly 2001; Halpern, 2001; Leaver-Dunn, Harrelson, Martin & Wyatt 2002). Without a uniform definition to underpin research, comparisons of results can be difficult. In order for the consumer of the research to apply the findings in a useful manner, it is important that the definition is made explicit.

The foundation for defining critical thinking includes its contrast. For example Paul (1990), a well known researcher in the field of critical thinking, is a strong proponent for the discontinuation of the over reliance on rote memorization in schools and for students to engage in a deeper more complex way of thinking. Paul advocated moving towards an active, independent, and self-directed learning process. In order for this self-direction to occur, Paul suggested students engage in critical thinking. Paul defined critical thinking as thinking about your thinking while you're thinking in order to make your thinking

better (1993, p.91). Paul's conceptualization implies a metacognitive process by the student and is foundational to the skill.

Duchscher (1999) explored the concept of critical thinking specific to the health related field. His research investigated the comparisons between languages in different disciplines and described critical thinking in the context of health care; for example problem solving, decision making, clinical judgment, and reflection. Paul provided a more detailed definition of critical thinking. Paul (1993) explained that critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing and evaluating information gathered from or generated by observation, experience, reflection, reasoning, or communication, as a guide to belief and action. This more robust definition is more attractive to some educators because it is more inclusive.

Robert Ennis, an educational philosopher, defined critical thinking as "reflective and reasonable thinking that is focused on deciding what to believe or do" (Ennis, 1985, p.45). Ennis asked the thinker to suspend judgment in order to consider alternate possibilities. This pause in making decisions is fundamental to the skill of critical thinking. Like Paul, Ennis used reflection as a central tenant to his definition. Paul and Ennis agreed that in order for someone to be considered a critical thinker they must engage in holding judgment until a process of reflection, which is an active process, occurs. Ennis is most known within the debate on how critical thinking should be taught. The most significant contribution of Ennis was to question whether critical thinking is subject specific or if it is transferable to other subjects/domains. Ennis (1989) explained that critical

thinking is domain specific and may not be transferable. He advocated if educators want students to apply critical thinking skills they must do so in a real world context and not in traditional classes designed to be subject specific.

Beyer (1995) provided a short definition of critical thinking, as simply making a reasoned judgment. Originally, Beyer (1995) provided a more in-depth definition of critical thinking “Autonomous, purposeful, reasoned thinking which enables an individual to determine the authenticity, accuracy, consistency, objectivity and worth of information, arguments and knowledge claims” (p.8). For this definition, Beyer built upon the reasoned thinking and emphasized the importance of the individual in performing this skill. McPeck (1981) stated critical thinking is the inclination and skills to engage in an activity with reflective skepticism. McPeck’s definition required a certain skepticism, or suspension of assent, towards a given statement, established norm or mode of doing things by the person engaged in the critical thinking process. McPeck’s definition is similar to Ennis’ and Paul’s in which the thinker does not take the truth for granted, however considers alternative hypotheses.

Watson and Glaser (1991) incorporated three dimensions into their definition of critical thinking: attitude, knowledge, and skills. Daly (1998) clearly defined these three dimensions:

Critical thinking is a composite of attitudes, knowledge and skills that include: 1. Attitudes of enquiry that involve an ability to recognize the existence of problems and an acceptance of the general need for evidence in support of what is asserted to be true;

2. Knowledge of the nature of valid abstractions, and generalizations in which the weight or accuracy of different kinds of evidence is logically determined; 3. Skills in employing and applying the above attitudes and knowledge. (p.325)

Watson and Glaser (1991) felt all three were necessary for someone to engage in critical thinking.

Brookfield (1987), similar to Ennis, included self reflection as a central tenant of critical thinking. Brookfield's definition was more complex than Ennis, as he explored the concept of analyzing personal assumptions or as Brookfield labeled, hunting assumptions. Brookfield explained how students begin to critically think when they identify and challenge assumptions they hold. This can only be done by challenging the impact of context, and imagining alternative solutions (Brookfield, 1987). Critical self reflection, with the intent of revealing and acknowledging ones own assumptions is considered by Brookfield to be the most difficult aspect of critical thinking. Becoming aware of the assumptions we hold help frame how individuals think and act is one of the most puzzling intellectual challenges students face (Brookfield, 1995). Brookfield was also similar to Dewey in his argument for the necessity of critical thinking in order to form a more democratic society. However, society cannot truly be democratic without questioning from those participating in it. Therefore, Brookfield (1995) argues self reflection does not go far enough. Reflection must consider where and how power undergirds society.

Critical thinking can be conceptualized as a higher order thought process bound within a developmental spectrum. Piaget's Theory of Cognitive Development is most widely credited with the notion of brain development moving from a simple to complex state with the person's cognition being conceptualized as simple to complex (Ormrod, 2008). This process does not mention critical thinking specifically, but it is clear that Piaget's *mental operations* were describing higher order thinking (Ormrod, 2008). Piaget was not the first to conceptualize cognition into levels. Tyler Bloom, in 1956, developed what is referred as Bloom's Taxonomy of Educational Objectives. Bloom's Taxonomy (1956) is an educational guide that lists more complicated mechanisms of thought that progress through a hierarchy. This list of skills moves from simple to complex.

Blooms Taxonomy:

1. Knowledge: the ability to recall specific information
2. Comprehension: understanding or perceiving information
3. Application: utilizing information in the correct manner
4. Analysis: Dissecting information from it whole to its parts
5. Synthesis: Blending of information to make it whole
6. Evaluation: Making judgment about value

Some authors have used Bloom's levels to define critical thinking based on which level an individual has achieved. Fuller (1997) determined critical thinking was occurring by discovering if students, through written examination, were utilizing the top four levels of Bloom's taxonomy. Occupational therapy

literature has borrowed Bloom's taxonomy as a measure of critical thinking.

Velde and Wittman (2006) used a two group experimental design to determine if a relationship between critical thinking and clinical decision making could be found. Clinical decision making is the ability of a clinician to make the appropriate judgment in order to provide health care in a specific context. In allied health and medicine a clinical decision is routed through an algorithm and not necessarily a higher order thought process is needed by the clinician. In this study, critical thinking was conceptualized as the top three levels of Bloom's Taxonomy.

It's important to note that Bloom's taxonomy is not a true definition or conceptualization of critical thinking but simply a tool to help explain *higher order thinking*. The objective of Bloom's Taxonomy is a hierarchy of cognition to assist curricular planning and incorporate objectives into lesson plans (Bloom, 1956). The hierarchy lists cognition from simple to complex, and concrete to abstract and appears to not reach the depth and breadth of some of the more modern conceptions of critical thinking.

The literature on critical thinking is saturated with different concepts and definitions. Scholars are left asking how educators assess critical thinking and how researchers study critical thinking. In the field of allied health and nursing the same dilemma has been articulated. As already mentioned many authors have voiced concern about no agreed upon meaning of critical thinking (Adams, Stover & Whitlow 1999; Adams, Whitlow, Stover & Johnson, 1996; Allen 2004; Daly 2001; Cise, Wilson & Thie, 2004; Halpern, 2001; Leaver-Dunn, Harrelson, Martin & Wyatt 2002; Profetto-McGrath, 2003; Twibell, Ryan & Hermiz, 2005). It

is clear that, for this topic to be studied, researchers must operationalize it for the reader. This perception is supported in the literature (Colucciello, 1997; Daly 2001; Halpern, 2001; Leaver-Dunn, Harrelson, Martin & Wyatt 2002; Twibell, Ryan & Hermiz, 2005).

The lack of consistency led to a 1990 American Psychological Association (APA) sponsored study to formulate a consensus on the definition of critical thinking. The APA convened a forty-six member panel led by Dr. Peter Facione, to utilize the Delphi method to develop a position statement as to what constitutes critical thinking. The panel consisted of scholars who held expertise in critical thinking theory, instruction, and assessment. The study took place over two years and consisted of six rounds of questioning and subsequent responses from within the panel. The expert panel defined critical thinking and the ideal critical thinker to be:

We understand critical thinking to be purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based. Critical thinking is essential as a tool of inquiry. As such, critical thinking is a liberating force in education and a powerful resource in one's personal and civic life. While not synonymous with good thinking, critical thinking is a pervasive and self-rectifying human phenomenon. The ideal critical thinker is habitually inquisitive, well-informed, trustful of reason, open-

minded, flexible, fair-minded in evaluation, honest in facing personal biases, prudent in making judgments, willing to reconsider, clear about issues, orderly in complex matters, diligent in seeking relevant information, reasonable in the selection of criteria, focused in inquiry, and persistent in seeking results which are as precise as the subject and the circumstances of inquiry permit (Facione, 1990, p. 2).

The project provided a list of cognitive skills including interpretation, analysis, evaluation, inference, explanation and self-regulation (Facione, 1990). Table 2 defines the cognitive skills and the associated sub-skills for each. The literature in the field of allied health, nursing, and medicine draws upon the results of the APA Delphi study frequently (Adams, Whitlow, Stover & Johnson, 1996; Allen 2004; Beckie, Lowery & Barnett, 2001; Bartlett & Cox 2002; Chau, Chang, Lee, Ip, Lee & Wotten 2001; Colucciello, 1997; Daly 1998; Duchscher, 1999; Fero, Witsberger, Wesmiller, Zullo & Hoffman 2009; Giancarlo & Facione, 2001; Leaver-Dunn, Harrelson, Martin & Wyatt 2002; Profetto-McGrath, 2003; Profetto-McGrath, Hesketh, Lang & Estabrooks, 2003; Stewart & Dempsey, 2005; Simpson & Courtney, 2002; Twibell, Ryan & Hermiz, 2005; Walker 2003). Furthermore, these fields utilized the APA's definition of critical thinking as a foundation to study critical thinking. Therefore, the definition of critical thinking put forth by the work of the APA Delphi Study was the definition used for this investigation.

Critical Thinking Disposition Compared to Skill

The conceptualization of critical thinking focusing solely on the skill is incomplete (Giancarlo & Facione, 2001). Many authors acknowledge the dual importance of skill and disposition when discussing, teaching, or measuring critical thinking (Colucciello, 1997; Giancarlo & Facione, 2001; Profetto-McGrath, 2003; Profetto-McGrath, Hesketh, Lang & Estabrooks, 2003; Stewart & Dempsey, 2005; Simpson & Courtney, 2002). As previously mentioned, John Dewey wrote about the intellectual virtues or overall disposition to think critically nearly a century ago. Disposition is considered a person's inclination or predisposition to think critically (Giancarlo & Facione, 2001). Therefore, disposition towards critically thinking is considered a personality trait that refers to the likelihood someone would utilize the skill.

The consideration of disposition toward critical thinking has mostly been within the realm of theoretical speculations and pedagogical discussions (Facione, Sanchez, Facione & Gainen, 1995). Therefore, there has been little done to scientifically investigate and or provide empirical evidence to measure critical thinking disposition. The most common instrument in use to provide some empirical validation as to a student's predisposition to thinking critically is the California Critical Thinking Disposition Inventory (CCTDI). The CCTDI like the CCTST derives its conceptualization from the APA Delphi report (Facione, Sanchez, Facione & Gainen, 1995).

Educators value both the disposition and skill of critical thinking (Facione, 2000). As part of the APA Delphi study seven critical thinking dispositions were

listed: truth-seeking, open-mindedness, analyticity, systematicity, CT self-confidence, inquisitiveness, and maturity of judgment (Facione, Facione, & Giancarlo, 1997). This disposition to think critically does not guarantee that an individual will utilize the disposition and, therefore, will not carry over to a measurable skill. Some have hypothesized that critical thinking skills are positively correlated with the internal motivation to critically think and some studies conflict. Coulucciello (1997) found a positive correlation between skill and disposition where as Facione (2000) found no correlation between disposition toward and skill in critical thinking.

Demonstrating a high skill in critical thinking does not assure one is disposed and being disposed toward critical thinking does not guarantee one will demonstrate skill (Facione, 2000). The investigation as to someone's disposition to critically think is extensive and equally important to the skill. Walsh and Hardy (1999) measured critical thinking disposition in six different college majors and found truth seeking scores to be the lowest among all fields of study. This is consistent with the majority of studies measuring critical thinking dispositions. Most North American studies consistently reveal significantly low scores in truth-seeking compared to the other six dimensions (Facione, 2000).

Critical thinking skill and dispositions are both valued, however, are considered two separate things (Facione, 2000). Motivational theorists suggest that motivation or internal desire would help decrease the potential gap between what the persons is disposed to compared to skill demonstrated. This study

focused on skill only and did not consider persons internal motivators to perform the skill.

Critical Thinking in Higher Education

Liberal education has been the cornerstone of higher education in the United States. To be liberally educated simply means an individual is empowered and prepared to deal with complexity, diversity and change (American Association of Colleges and Universities, 2011). This liberal education should liberate the student's mind and allow for the development of social responsibility as well as practical skills that can be applied in a real world context. This definition is congruent with Deweyian teaching. The foundation of liberal education in higher education within the United States predates Dewey.

Those persons, whom nature has endowed with genius and virtue, should be rendered by liberal education worthy to receive, and able to guard the sacred deposit of the rights and liberties of their fellow citizens; and they should be called to that charge without regard to wealth, birth or other accidental condition or circumstance.

Thomas Jefferson: Diffusion of Knowledge Bill, 1779.

In the late eighteenth-nineties, in the United States less than ten percent of fourteen to seventeen year olds were enrolled in high school and fewer than three percent graduated (Tyack & Cuban, 1995). Even fewer attended institutions of higher learning. Although few American citizens received higher education, the split between liberal and practical education has been prominent in our country. In 1862, President Abraham Lincoln signed the Morrill Act which essentially was

the construction of today's system of public colleges. The purpose of these land-grant colleges was to promote both the liberal and the practical education of the masses. Teaching with the intended outcome of the student's ability to think is central to the concept of liberal education (Giancarlo & Facione, 2001). The premise that a person who is well educated and able to think for himself or herself is considered to have a *liberated mind* is still the focus of many higher education institutions. Critical thinking for the intent of thinking liberally is essential in higher education and is well supported in the literature (Duron Limbach & Waugh, 2006; Cise, Wilson & Thie, 2004; de Sanchez, 1995; Giancarlo & Facione, 2001; Halpern, 2001).

Today a significant goal of educators in higher education is to teach students to think better than they did prior to arriving to college (Pither & Soden, 2000; Williams, Wise & West, 2001). This goal has promoted some disciplines to include critical thinking as an outcome standard for their respective programs (Beckie, Lowry & Barnett, 2001). However, some evidence suggests there is limited critical thinking development in today's college classrooms (Tsui, 2002).

Teaching Critical Thinking

Dewey's influence is found in contemporary investigation of teaching critical thinking. Duron, Limbach and Waugh (2006) identified a five-step framework for teaching critical thinking. This framework rested on existing theory and best practices in cognitive development and is most closely compared to Bloom's Taxonomy (1956). Duron, Limbach and Waugh's framework is as follows; determine learning objectives; teach through questioning (divergent) not

lecture; practice before you assess; review, refine and improve using student feedback; and provide feedback and assessment of learning which should focus on formative evaluation. Duron et al. (2006) agreed with Dewey that critical thinking is an active process and should be taught in that manner. Duron et al. went on to criticize today's higher education environment in which too much time is spent on solving well-structured deterministic problems, placing emphasis on memorization, being reluctant to develop creative types of learning experiences, and focused excessively on content at the expense of critical thinking skill development.

Critical thinking requires students to be actively involved in the cognitive process versus to passively absorb information (Duron, et al, 2006). In higher education many have studied ways to encourage this active versus passive process by the student. A lecture format, often utilized in college classes, generally does not encourage critical thinking by the students (Duron, et al, 2006). Teacher-centered approaches, such as lecture formats normally occur in a linear fashion and do not allow for the interaction and input by the student. This places the student in a passive position versus an active one and the act of questioning does not occur. Browne and Freeman (2000) explained that questioning by the instructor to initiate questions generated by the student is vital for critical thinking to occur. Instructors reinforce critical thinking by their students when they systematically ask *Why* (Browne & Freeman, 2000). Walker (2003) supports this action of questioning by the instructors in order to encourage the students to critically think. Walker suggested questioning to be a quintessential

activity to be an effective teacher. However, the activity of questioning is only as good as the questions being asked. Clinical instructors often ask lower level cognitive questions than higher-level questions (Phillips & Duke, 2001).

Active learning has also been shown to promote critical thinking (Duron, Limbach & Waugh, 2006). Active learning often takes the form of debates and discussions, which by their nature can promote critical thinking (Walker, 2003). Teachers feeling a need to cover material will provide some exposure of information to the students. However, until they do something active with it, there is little chance the information will be retained and certainly no chance of the students critically thinking. It has been shown that students must be given an opportunity to discuss and debate information in order to think about information on a deeper level. During discussions ideas become more meaningful as a result of synthesis, and critical thinking is required of them to present their ideas (Browne & Freeman, 2000). However, if conflict occurs during the discussion and students revert back to arguments, critical thinking will be negated (Browne & Freeman, 2000). Browne and Freeman (2000) recommend instructors in higher education intentionally initiate conflict in their classrooms. This disagreement in thought will create discomfort in the students and generate intellectual uneasiness, which promotes critical thinking in the students. Students will be forced to self reflect on what they value, believe and think. If instructors help to create an environment of reflection and engage in reasoned judgment the students will be a better able to develop critical thinking skills (Browne & Freeman, 2000).

Critical thinking also can be promoted in higher education through writing assignments returned to the students with instructor feedback (Tsui, 1999). Walker (2003) supported this notion of critical thinking improvement through both in and out of class written assignments. Tsui's work revealed instructors who encouraged written essays versus multiple choice increased students' ability to critically think. Popham (2006) supports Tsui's work in that written essay test questions stimulate the top levels of Bloom's Taxonomy. Written work in which the students need to construct their responses versus selecting a response given to them will foster higher order thinking. In addition, written work may give the students even more time to self-reflect. Therefore, assignments that are a combination of students accessing the upper levels of Bloom's Taxonomy along with increased time to self-reflect can be considered an option to increase critical thinking in students.

Measuring College Students Critical Thinking

The quantification of critical thinking skills is often highly valued in today's education environment in which measured outcomes are viewed as evidence of accomplishment. This axiological assumption is even stronger in the medical and allied health fields. Critical thinking abilities based on quantification always have been of great value to the nursing field (Adams et al., 1996). Several instruments have been generated to measure critical thinking in college students and more specifically in medical and health related fields (Giancarlo & Facione, 2001). Each instrument has its own strengths and weakness. The most commonly used tools to measure critical thinking skills are the Watson-Glaser Critical Thinking

Appraisal (WGCTA), the California Critical Thinking Skills Test (CCTST), the Ennis-Weir Critical Thinking Essay Test (EWCTET), and the Cornell Critical Thinking Test (CCTT). The WGCTA and the CCTST are two of the most commonly used tools to assess critical thinking skills in college aged students (Adams et al., 1996). In addition the CCTST and the WGCTA are the most common instruments in assessment of critical thinking skills in allied health. Adams and her research team provide a comparison of the four tests in Table 1.

Table 1

Characteristics of the Four Critical Thinking Instruments

Instrument	Theoretical Definition of Critical Thinking	Subscales	Format	Target
WGCTA	Composite of attitudes Knowledge, and skills	Inference Recognition of assumptions Deduction Interpretation Evaluation of arguments	Forms A & B 80 items 40 min to complete	9 th grade
CCTST	Process of purposeful Self-regulatory judgment	Analysis Evaluation Inference Inductive Deductive	Forms A & B 45 min to complete	College
EWCTET	No definition given	Getting the point Stating one's point Offering good reasons Seeing other possibilities Equivocation Irrelevance	Essay format 40 min to complete	9-12 grade college
CCTT	Process of reasonably Deciding what to Believe and do	Induction Deduction Value judgment Observation Credibility Assumptions Meaning	Level X and Z Level Level X-71 items Level Z-52 items 50 min to complete	4 th grade to college Level Z: college

From: Adams, M. H., Whitlow, J. F., Stover, L. N. & Johnson, K. W. (1996). Critical Thinking as an Educational Outcome. *Nurse Educator*, 21(3), 23-32.

Adams et al. (1999) reviewed prior research on the utilization of the WGCTA and the CCTST and determined the CCTST reflects critical thinking ability in allied health professions more accurately than the WGCTA. However,

both the WGCTA and the CCTST were designed to measure *general* critical thinking abilities in college age students (Behar-Horenstein & Niu, 2011). The CCTST measures specific cognitive skills of interpretation, analysis, evaluation, explanation and inference (Facione, 1990). Controversy exists in the field of critical thinking as whether it is discipline specific or a global construct (Behar-Horenstein & Niu, 2011). Neither test is specific to any particular field of study nor are results intended to determine skills in the specific domains mentioned. Furthermore, both tests have been found to be valid and reliable in measurement of an abstract conception of critical thinking.

The WGCTA was built from Watson and Glaser's (1980) definition of critical thinking which is a combination of attitudes, knowledge, and skills, indicating a predisposition and action component. The WGCTA was designed in 1964, with subsequent modifications and as previously stated was the most widely used instrument in medical education until the mid nineteen-nineties. Scott, Market, and Dunn (1998) evaluated changes in critical thinking skills in medical students utilizing the WGCTA and found students significantly improved from entry to exit. In addition, Scott et al, (1998) concluded the student WGCTA scores correlated with their scores on their Medical Licensing Examination. However, the authors caution even though the scores on the WGCTA could be viewed as having a predictive ability for students' success on the licensing examination the WGCTA is a non-specific test and must be viewed in combination with other criteria (Adams, et. al, 1999).

The CCTST was developed by Facione in 1994 to measure certain critical thinking skills: analysis, evaluation, inference, deductive and inductive reasoning (Facione, 1994). The test is based on the consensus conceptualization of critical thinking that emerged from the Delphi research project by the American Philosophical Association (APA) (Facione, 1994). Prior to this test the concern was most tests lacked validity and reliability. The CCTST has proven to be highly reliable and yields its content validity from the APA definition (Facione & Facione, 1994b). The test measures the students' ability to comprehend material along with its relationships with other statements, questions or opinions. In addition, the CCTST measures college students' deductive reasoning, going from general to specific and inductive reasoning, going from specific to general. Facione developed the test to investigate critical thinking in higher education and it is the most common test used in contemporary literature to study critical thinking in allied health.

The EWCTET measures the degree to which participants are able to evaluate an argument taken from a written essay (Adams, et al., 1996). This test is not built on any specific definition, however, Ennis defined critical thinking as reflective and reasonable thinking focused on deciding what to believe or do with a willingness to reconsider or change thinking. The significant difference in this test from others is it does not contain objective questions (Adams, et al., 1996). Students are evaluated on their skill of getting the point, identifying reasons and assumptions, offering good reasons, seeing other alternatives and responding to logical arguments. The concern with this test is the students' ability to write will

greatly affect the reliability of the exam. More importantly the reason this exam is not used often is the subjectivity in scoring and the large time commitment devoted to taking and scoring the exam (Adams, et al., 1996). No studies were found in allied health or medicine that utilized the EWCTET.

The last common test found in the literature is the CCTT, also designed by Ennis. The CCTT is intended to measure the seven skills of induction, deduction, value judgment, observation, credibility, identifying assumptions, and finding meaning (Adams, et al., 1996). Most research utilizing the CCTT is in non-medical or non-health related fields. The majority of the research explored differences in critical thinking among high school aged students. For example, no difference was found in critical thinking between high school students exposed to technology and those who were not (Mahoney in Adams, et al., 1996). In addition, no difference was found between different high school biology students exposed to intentional critical thinking instruction and those who were not (Zohar and Tamir in Adams, et al., 1996).

All four tests have shown a certain degree of reliability and validity and therefore are reasonable instruments. However, the EWCTET and the CCTT focus on the analysis of a limited number of critical thinking skills (Adams, et al., 1996). The CCTST is the most broad and most often used in allied health today. The WGCTA was considered the best metric to use until the CCTST came into use in 1994.

California Critical Thinking Skills Test

The CCTST is the instrument found most often in the allied health and nursing literature (Bartlett, 2006; Williams et al., 2003; Velde et al., 2006). The construction of this tool is based on the consensus of the expert panel participating in the Delphi study conducted by the APA. The CCTST has been thoroughly scrutinized and has been found to be both valid and a reliable metric for the measure of general critical thinking skills in college age students. Due to the large volume of research in allied health that has used this instrument along with the evidence to demonstrate valid and reliable scores, the CCTST has been chosen for the working framework of this study.

The CCTST provides an overall critical thinking skill score as well as six critical thinking skills and sub-scale scores. Definitions of the six sub-scales are presented in table 2.

Table 2

Consensus Descriptions of Core Critical Thinking Skills

Cognitive Skill	Definition
Interpretation	To comprehend and express the meaning or significance of a wide variety of experiences, situations, data, events, judgments, conventions, beliefs, rules, procedures or criteria.
Analysis	To identify the intended and actual inferential relationships among statements, questions, concepts, descriptions or other forms of representation intended to express beliefs, judgments, experiences, reasons, information, or opinions.
Evaluation	To assess the credibility of statements or other representations which are accounts or descriptions of a person's perception, experience, situation, judgment, belief, or opinion; and to assess the logical strength of the actual or intended inferential relationships among statements, descriptions, questions or other forms of representation.
Inference	To identify and secure elements needed to draw reasonable conclusions; to form conjectures and hypotheses; to consider relevant information and

to educe the consequences flowing from data, statements, principles, evidence, judgments, beliefs, opinions, concepts, descriptions, questions, or other forms of representation.

Explanation	To state the results of one's reasoning; to justify that reasoning in terms of the evidential, conceptual, methodological, criteriological and contextual considerations upon which one's results were based; and to present one's reasoning in the form of cogent arguments.
Self-Regulation	Self-consciously to monitor one's cognitive activities, the elements used in those activities, and the result educed, particularly by applying skills in analysis and evaluation to one's own inferential judgments with a view toward questioning, confirming, validating, or correcting either one's reasoning or one's results.

From: Facione, P. A. (1990). *Critical Thinking: A Statement of Expert Consensus for Purposes of Educational Assessment and Instruction. Executive Summary "The Delphi Report"*. Millbrae: The California Academic Press. (ERIC Reproduction Service No., ED315423).

Critical Thinking in Allied Health Professions

The importance for health care providers to be good critical thinkers has always existed. Critical thinking is a global goal in higher education, and there are many who have adopted it as a desired goal for medical and allied health professional educational programs. This need for critical thinking is linked to the needs of future health care practitioners working in an ever complex environment. Brock and Butts (1998) indicated the future will require new graduates to think critically, be able to recognize complex clinical phenomena and make relationships with unknown potential solutions. Beckie, Lowery and Barnett (2001) indicated the current environment of health care is going through rapid change, and those who want to participate in its delivery must be critical thinkers. The future has no place for systematic thinking but requires instead a deeper open-mindedness to an array of possible answers. This need will continue to increase as the needs of patients living in a complex system

increase. Survival of the health care industry and society for which it cares for may actually depend on the ability of individuals to explore multiple alternatives and make decisions based on critical thinking (Twibell, Ryan & Hermiz, 2005).

As previously mentioned the advocacy of critical thinking can be traced back prior to the formation of modern day schools. However, educational systems have found a renewed emphasis on critical thinking in reaction to preparing learners for the twenty-first century. Health care education is responsive to the needs of society and must reflect societal patterns of increasing complexity and constant change. Therefore, health care educators must prepare students to critically think in order to thrive and survive in this ever evolving world (Twibell, Ryan & Hermiz, 2005). Medical education curriculums are notoriously overburdened with large numbers of competencies and proficiencies students must meet. This leaves educators little time for reflection and debate. Lack of reflection and debate can lead to a decrease in critical thinking (Browne & Freeman, 2000). However, the literature is rich with many educational administrators addressing critical thinking in their allied health and nursing curriculums (Allen, 2004; Bartlett & Cox, 2002; Fuller, 1997; Chau, Chang, Lee, Ip, Lee & Wotten 2001; Leaver-Dunn, Harrelson, Martin & Wyatt 2002; McCarthy, Schuster, Zehr & McDougal 1999).

The recognition of the importance of critical thinking throughout health care is expansive and inclusive. Critical thinking has become so prominent and absolutely necessary for health care providers that it has become an outcome of nursing education programs (Beckie, Lowry & Barnett, 2001; Colucciello, 1997;

Stewart & Dempsey, 2005; Twibell, Ryan & Hermiz, 2005). The importance of students to think critically is fundamental to the field of occupational therapy (Velde, Wittman & Vos, 2006). Occupational therapy students will work in the same multifaceted environment in which others in allied health care work and consequently must be ready for the complexities of these environments. Therefore, critical thinking has been intentionally incorporated into models of education for occupational therapists and has been considered a prerequisite to being an *ideal* practitioner (Velde, Wittman & Vos, 2006).

Similar to the importance for critical thinking in occupational therapy, dentistry and dental education have also acknowledged the increasing value for students to critically think. Dentists need to analyze and evaluate their thinking in making decisions (Johnson, Finkelstein, Marshall & Chalkley, 2009). Therefore, the need to evaluate critical thinking ability is increasing in the dental education field. Critical thinking has been added to the Commission on Dental Accreditation revised standards (Behar-Horenstein, Dolan, Courts & Mitchell, 2000). Medical schools have also expanded their exploration into critical thinking and have listed it as a desired trait of physicians (Lieberman, Trumble & Smith, 2000; Scott, Markert & Dunn, 1998; West, Pomery, Park, Gerstenberger & Sandoval, 2000). Therefore, physician preparation training is infusing critical thinking into their curricula.

All of these allied health and medical fields note the importance of critical thinking and are beginning to determine ways of teaching and evaluating this process. However, the field of nursing has undergone the greatest exploration

into the topic of critical thinking (Swiger, 2005). The importance of critically thinking in nursing is found throughout the literature and will be addressed in the following section (Brock & Butts, 1998; Colucciello, 1997; Profetto-McGrath, 2003; Profetto-McGrath, Hesketh, Lang & Estabrooks, 2003; Stewart & Dempsey, 2005).

Critical Thinking in Nursing

There has been a proliferation of literature in nursing focusing on critical thinking beginning in the mid 1990's. Publications of critical thinking date back to the late 1970's, however, the majority of studies have been published since critical thinking was listed as a criteria for accreditation by the National League for Nursing (NLN) in 1992 (Stewart & Dempsey, 2005). As a result, many nursing educational programs measure critical thinking in both entry and completion of their, programs. After reviewing the literature, it is apparent that nursing more than other medical or allied health fields has undertaken the most complete assessment of critical thinking skills in college-aged students. The NLN mandate has led to an abundance of quantitative scores on critical thinking. The most comprehensive was published by Facione and Facione (1997), which compiled aggregate data on nursing CCTST scores and established normative data.

Table 3

Critical Thinking Skills in Nurses by Level of Class

SOPHMORES	N	Mean	Standard Deviation
CCTST	1485	15.70	4.03
Analysis	1281	4.53	1.42
Evaluation	1281	5.62	2.18
Inference	1282	5.64	1.85
Deduction	1245	7.30	2.33
Induction	1245	6.65	2.17

JUNIORS	N	Mean	Standard Deviation
CCTST	1618	16.11	3.70
Analysis	1095	4.49	1.21
Evaluation	1097	5.46	1.78
Inference	1097	5.84	1.61
Deduction	1030	7.49	2.22
Induction	1031	6.71	1.83
SENIORS	N	Mean	Standard Deviation
CCTST	2611	16.40	3.55
Analysis	1772	4.59	1.32
Evaluation	1772	5.72	1.87
Inference	1770	5.71	1.67
Deduction	1725	7.25	2.12
Induction	1726	6.93	1.99

From: Facione, N. C. & Facione, P. A. (1997). *Critical thinking assessment in nursing education programs: An aggregate analysis*. Millbrae: The California Academic Press, pp. 19-21.

These changes have stimulated nursing programs to foster critical thinking through changes in teaching practices and explore alternatives to relying on rote memorization by students (Beckie, Lowery & Barnett, 2001).

The ability of a nurse to be an effective critical thinker has always been important but similar to other domains of health care this skill has a renewed emphasis. Nurses, similar to other health care delivery personnel, must serve in an environment that is constantly evolving with ever increasing complexity. Critical thinking is an essential core competency for nurses because of the need to keep pace with the twenty first century demands of health care (Beckie, Lowery & Barnett, 2001). Desired cognitive adaptability of a nurse, similar to an athletic trainer coupled with the multitude of studies exploring critical thinking in its field, make the exploration of critical thinking literature in nursing important and relevant to this study.

The significance of critical thinking in nursing is well documented (Adams, Whitlow, Stover & Johnson, 1996; Brock & Butts, 1998; Colucciello, 1997; Profetto-McGrath, 2003; Stewart & Dempsey, 2005). However, there are noteworthy concerns regarding the study of critical thinking in the nursing literature. Author's and researchers' acknowledgment of the lack of consistency in defining critical thinking specific to the field of nursing is a common theme. Table 4 list definitions of critical thinking found in the nursing literature.

Table 4

Definitions of Critical Thinking in Nursing Literature

Author	Definition
Brock & Butts (1998)	Critical thinking is a reflective process that involves thinking about the patient circumstances without a single solution and <i>is focused on deciding what to do that reaches a successful outcome to meet the patient's needs.</i>
Daly (1998)	Avoiding the indiscriminate acceptance of one-sided (face value) arguments, and avoiding the indiscriminate construction and defense of one-sided arguments.
Halpern (1993)	Thinking that is purposeful, reasoned, and goal directed.
Facione & Facione (1997)	Critical Thinking is non-linear, recursive process in which a person forms a judgment about what to believe or what do in a given context.

Definitions range from general to specific conceptualizations of critical thinking.

The second area that has caused trepidation in the authors of critical thinking studies in nursing, is the lack of standardized assessment tools available to evaluate critical thinking skills (Allen, Rubenfeld & Scheffer, 2004). As a result critical thinking has been taught and assessed in many different forms.

A task force from Indiana University School of Nursing in 1997 formed to develop a theoretical framework for teaching and assessing critical thinking in an

attempt to mitigate this perceived concern over multiple definitions of critical thinking. Indiana University School of Nursing is one of the largest schools of nursing and held the necessary resources to explore the topic. The task force concluded there would be no one *right* way to theoretically define the dimension of critical thinking (Dexter et al., 1997). The framework this task force developed to operationally define critical thinking was a list of categories or components. Interpretation, analysis, evaluation, inference, explanation, and self re-regulation were identified (Dexter et al., 1997). These categories are consistent with the APA Delphi study's list of cognitive skills of interpretation, analysis, evaluation, inference, explanation and self-regulation (Facione, 1990).

Specific to nursing, Facione, Facione and Giancarlo (1997) discussed the cognitive skills needs to support the habits of mind needed. Facione et al., advocated not only for educators to instill mental habits of skill utilization, but students must practice those skills. This is reminiscent of Dewey's habits of mind. Profetto-McGrath (2003) suggested the need for students to have both the disposition to think critically and the cognitive skills to do so in nursing or in general.

Assessment of Critical Thinking in Nursing

Assessment of critical thinking is crucial as it has become an outcome standard in nursing education. The two most common tools used to assess critical thinking in nursing are the Watson-Glaser Critical Thinking Appraisal (WGCTA) and the California Critical Thinking Skills Test (CCTST) (Becki et al., 2001). For the most part the early studies in nursing used the WGCTA (Stewart &

Dempsey, 2005). Studies using the WGCTA demonstrated inconclusive results. The WGCTA was constructed to measure inference, recognition of assumptions, deduction, interpretation, and evaluation of arguments. These skills were borrowed from the work of Dressel and Mayhew (1954). Since the APA definition of critical thinking (1990) and the subsequent creation of the CCTST in 1994 the majority of nursing studies, related to measurement of critical thinking skills used the CCTST.

Sullivan (1987) found no significant difference between entry and exit scores of nursing programs whereas Gross, Takazawa & Rose (1987) determined a difference existed. Studies that took place in the mid nineteen-eighties, including Sullivan's and Gross et al, research, utilized the Watson Glaser Critical Thinking Assessment instrument. Most research from the nineteen-nineties, including contemporary studies made use of the California Critical Thinking Skills Test (CCTST), which was constructed on the conception of critical thinking by the 1990 APA sponsored Delphi study.

The largest collection of critical thinking skill data was generated from studies published by Facione and Facione (1997). They helped provide baseline aggregate data on critical thinking skills in nursing. Facione and Facione collected data from 50 different nursing education programs and utilized both the CCTST and the CCTDI to determine baseline scores for nursing students. The work by Facione and Facione examined many different variables that may affect critical thinking scores. Education level, pretest/post test scores, age and gender of students were all analyzed. Facione and Facione (1997) determined that

critical thinking skill does increase throughout years of schooling as posttest scores for undergraduate nursing students were significantly higher than pretest scores. Data comparing males to females' changes in critical thinking scores from pretest to post test were not significantly different. Indicating that the change in critical thinking over the course of nursing education is not impacted by gender.

Another cross sectional study was concluded by Colucciello (1997) who assessed critical thinking skills in nursing students between second semester sophomores, first semester juniors, and first and second semester seniors of baccalaureate nursing education. Analysis of the test scores revealed significant differences in critical thinking scores among the students at different academic levels (Colucciello, 1997). Scores ranged from 14.97 to 17.60 with second semester sophomores scoring the lowest and first semester juniors scoring the highest. Colucciello offered an explanation for the possible difference in scores as being related to grade point average. Sophomores not having been formally admitted into the nursing program may have had GPA's lower than the minimum required 2.75 (Colucciello, 1997). However, this is rejected by the work of Giancarlo and Facione (2001) who found no relationship between critical thinking and grade point average.

Other studies exploring the difference in critical thinking skill score between program entry and exit have found mixed results. McCarthy, Schuster, Zehr, and McDougal (1999) analyzed critical thinking skills and dispositions of sophomores compared to senior nursing students. This cross sectional study

revealed a statically significant difference between groups using the CCTST test. Seniors scored significantly higher than sophomores on four of the seven subscales of critical thinking (McCarthy, Schuster, Zehr & McDougal, 1999). Another cross sectional design using the CCTST examined four different groups of nursing students at different points of their education (Profetto-McGrath 2003). A small increase in critical thinking skill score was found but no significant difference was determined among the four student groups (Profetto-McGrath, 2003). Both of these studies utilized a cross-sectional research design and, therefore, it is difficult to determine what contributed to the changes or lack of change in critical thinking scores. Longitudinal research is warranted for this type of investigation.

Beckie et al. (2001) provided a longitudinal study exploring critical thinking scores in comparison to revisions in curriculum. Mixed results were found when testing three different cohort groups. The CCTST was administered at program entry, midpoint, and exit. Overall CCTST scores for the three groups ranged from 13.6-18.1 (Beckie et al, 2001). Group 1 served as a control while groups 2 and 3 were classes that were exposed to a curriculum infused with critical thinking. Group 2, which was the first group to experience the revised curriculum, demonstrated significantly higher critical thinking scores (Beckie et al, 2001). However, group 3 which also was exposed to the revised curriculum did not achieve statically significant higher critical thinking scores. Authors provided several explanations for this. Group three showed little motivation to perform well and were anxious to graduate (Beckie et al, 2001). This is consistent with the

work of Velde et al. (2006) who indicated a lack of motivation in occupational therapy students' assessment of critical thinking on a non field specific test.

The ability for citizens as well as students to critically think has always been important. Equally essential for those working in health care fields today is to exercise the process of critical thought. Researchers have investigated and reported upon a variety of results concerning critical thinking skills in hopes of validating their educational initiatives. These studies have utilized a variety of instruments based upon altering conceptualizations of critical thinking. It is important to focus on the field of athletic training education. The review of relevant literature regarding critical thinking specific to this field is necessary.

Brain Development

The exploration into developmental psychology and brain development literature revealed an expansive and deep body of knowledge. However, the majority of research in the field has been devoted to subjects that are to be considered in early childhood (Kohn, 2006). Research focusing on older adolescents into young adulthood, primarily examines self-directed learning process (Kuhn, 2006). Studies from the field of developmental psychology have close to a hundred years of exploration beginning with Edward Thorndike's book *Educational Psychology: The Psychology of Learning*, published in 1913. The exploration into brain development from a neurophysiological approach is relatively new. Empirical research into cognition and neural development throughout life is in its initial stages (Blakemore & Choudhury, 2006). Traditionally, researchers believed that synapogenesis peaked at age three and

future brain development was influenced mostly by synaptic pruning (Ormrod, 2008, p. 21). However, contemporary research indicates that synaptogenesis and synaptic pruning, especially in the prefrontal cortex may continue much later in life (Blakemore & Choudhury, 2006). The implications of this go beyond the scope of this paper.

The literature relevant to critical thinking in allied health and medical education, comparing graduate to undergraduate students may be helpful. Review of literature revealed an examination of CT in allied health graduate level of education virtually nonexistent. In addition there have been no studies published looking at undergraduate and entry level masters students in athletic training.

Nursing provides the closest comparison to athletic training education and has studies exploring critical thinking in graduate education. Four studies have been completed assessing CT in master level nursing students. All studies were exploring within group changes and were limited by size and homogeneity of sample (Seldomridge & Walsh, 2006).

History of Athletic Training & Athletic Training Education

Athletic training is practiced by health care professionals who collaborate with physicians to optimize activity and participation of patients and clients. Athletic training encompasses the prevention, diagnosis, and intervention of emergency, acute, and chronic medical conditions involving impairment, functional limitations, and disabilities (NATA, 2011). The birth of athletic training can be traced back to ancient Olympic Games in 776 B.C. At the time of

Hippocrates, there is evidence of treating athletic related injuries with the goal of not only improving performance, but restoring health and full function (Arnheim, 2011). However, it was not until the beginning of the twentieth century that the United States began acknowledging the need to care for and rehabilitate an athletic injury. As organized sport increased in participation so did the need for individuals trained in providing health care to this active population. The National Athletic Trainers Association (NATA) formed in 1950 in part to provide support and direction to this new area of expertise and bring recognition to the profession.

Prior to the NATA formation athletic trainers in the United States were employed exclusively in Universities and professional athletic teams and were not organized. Athletic trainers were not viewed as health care practitioners by others in or out of the established medical community. In 1956 the NATA Board of Directors authorized a committee to explore avenues in which the athletic training profession could be enhanced. The most significant way athletic training could be established as a profession was to construct educational standards for this emerging career (Delforge & Behnke, 1999). In 1959 the first NATA curriculum model for athletic training education was approved. At this time the curriculum was constructed for the employability of athletic trainers in two main areas. Students were prepared to become either secondary school teachers or have the foundational knowledge to go on and pursue a career in physical therapy. Physical therapy skills were recommended as a means to pursue further knowledge and professional growth (Delforge & Behnke, 1999). Therefore, many

practicing athletic trainers were also trained physical therapists. The passage of the Hospital Survey and Construction Act of 1946 led to an increase in hospital-based practice for physical therapists and an ever growing need for new physical therapists (Moffat, 2003). This increased the number of students studying physical therapy. Over the next ten years only four universities in the United States developed this recommended curriculum and, therefore, few athletic trainers were educated through any formalized training. The majority of those practicing athletic training in colleges and professional sports learned through apprenticeships. The athletic training curriculum that was recommended by the NATA in 1959 was an important step in developing a specialized body of knowledge. However the primary course work already existed in 4-year colleges and was similar to physical education or health (Delforge & Behnke, 1999). Therefore students interested in working as athletic trainers were encouraged to attend physical therapy schools.

A renewed emphasis of athletic training education began in 1969 when the NATA established the committee on Professional Education (Delforge & Behnke, 1999). Large numbers of students were entering physical therapy to treat polio victims. The Salk vaccine virtually eradicated poliomyelitis in the United States by 1961 and immediate need for physical therapy was diminished (Moffat, 2003). The role of the physical therapist and athletic trainers thus split on foundational views of rehabilitation. The athletic trainers focused on the population engaged in athletics and physical therapists focused on non-athletes needing to restore full orthopedic function. Perceptually, the body of knowledge

was different between athletic trainer and physical therapist. This bifurcation is the underpinning for much of the dissension between the two occupations that exists today.

In 1969 the NATA formally recognized the first undergraduate athletic training education programs (Delforge & Behnke, 1999). In conjunction with this event the first certification examination was administered, which provided a baseline evaluation of athletic training students knowledge and skill (Delforge & Behnke, 1999). The 1970's and early 1980's represented the greatest proliferation of athletic training education programs (Delforge & Behnke, 1999). The number of NATA approved curriculum programs grew from 4 to 62 within 12 years (Delforge & Behnke, 1999). The new curriculum established in the mid-1970's diminished work in pedagogy and coaching methods due to the declining opportunities in physical education and secondary health jobs. The curriculum that evolved emphasized a specific body of knowledge that was focused towards acute care of athletic related injures.

In 1980, the Board of Directors at the NATA wanted to require those educational programs that were NATA approved programs to offer their curriculum as a stand alone major. This would move the athletic training body of knowledge away from a concentration and increase the credibility of the profession (Delforge & Behnke, 1999). This provided a catalyst for the most significant changes in athletic training education. In 1983 the NATA established the Professional Education Committee (PEC) to oversee and provide guidance to athletic training education. The PEC established new Athletic Training Curriculum

subject matter to help schools that wanted to be considered to have a curriculum program. The PEC published the *Guidelines for Development and Implementation of NATA Approved Undergraduate Athletic Training Education Programs*. In contrast with older curriculum designs based on specific courses, the curriculum designs would be based on subject matter. The subject matter approach permitted greater flexibility in the development of educational experiences, with varying degrees of emphasis on specific learning outcomes (Delforge & Behnke, 1999).

By the 1990's the American Medical Association (AMA) formally recognized athletic training as an allied health profession (Delforge & Behnke, 1999). This endorsement was made possible by the AMA committee on Allied Health Education and Accreditation (CAHEA). The standardization and review of curriculum by an outside agency brought credibility to this new field of allied health (Delforge & Behnke, 1999). After athletic training received an endorsement from the AMA, the NATA joined with members of the American Academy of Family Physicians, the American Academy of Pediatrics and the American Orthopedic Society for Sports Medicine to create the Joint Review Committee on Educational Programs in Athletic Training Education (JRC-AT) (Delforge & Behnke, 1999). The JRC-AT was the governing body that provided athletic training education programs with a list of requirements to be accredited by CAHEA (Delforge, & Behnke, 1999). In 1991 the JRC-AT replaced the PEC's *Guidelines* and developed the *Essentials and Guidelines for an Accredited Educational Program for the Athletic Trainer*.

Between the 1980's and 2001 students were offered two different routes to certification in athletic training (Delforge & Behnke, 1999). One was the internship program that was firmly based on the apprenticeship model of clinical education and required 1500 hours of hands on learning under the guidance of a mentor (Grace, 1999). The other route was the more formalized education recognized by the NATA and more recently accredited by an independent agency. The NATA approved programs required a greater didactic component and only required the student to gain 800 clinical hours with active hands on learning (Grace, 1999). In addition students were expected to receive experience practicing skills on athletes involved in both contact and collision sports. This variation and intentionality of experience is still found in clinical education today.

The NATA Education Task Force in 1996 recommended they work in conjunction with the BOC to create new requirements for students to be eligible to sit for the exam. A requirement created from this association was for all candidates to have successfully completed a baccalaureate degree from a CAAHEP accredited school (Delforge & Behnke, 1999). Thus by 2004 only students that met this requirement could become certified athletic trainers; this eradicated all internship routes to certification.

Athletic Training Education has gone through three different accrediting bodies over the last 15 years. The PEC first moved from CEHEA to the Commission on Accreditation of Allied Health Education Programs (CAAHEP) in 1994 (Delforge & Behnke, 1999). CAAHEP accreditation provided congruency with other educational programs offered at Universities. In 2006 the JRC-AT

separated from CAAHEP and became the Commission on Accreditation Athletic Training Education (CAATE) thus providing accreditation to athletic training education programs.

Athletic Training Education Today

Presently there are three-hundred and sixty-nine athletic training education programs that are accredited by CAATE (Commission of Accreditation of Athletic Training Education, 2012). Three hundred and forty-three are undergraduate programs leaving twenty six schools offering entry level masters. Students graduating from one of these accredited programs are trained in the prevention, evaluation, and subsequent rehabilitation of orthopedic injuries by those involved in activity. Athletic trainers are prepared to and work in various environments including but not limited to clinics, hospitals, high schools, universities, professional athletic teams and most recently occupational therapy centers (NATA 2011). The education of athletic trainers is founded on two major domains. The cognitive domain is basic knowledge, comprehension and higher order thinking with emphasis on the upper levels of Bloom's taxonomy. Students receive a thorough foundation in anatomy, physiology, biomechanics and medical specific knowledge in injury prevention, orthopedic evaluation, and therapeutic exercise. The other domain is the psychomotor, in which students are expected to achieve a basic competency level of skill in eight different content areas (NATA, 2011). Today the PEC of the NATA generates a list of competencies that athletic training students are required to be competent in (NATA, 2011). The list of competencies is universal for both undergraduate as

well entry level graduate athletic training education programs. This most current list integrates the previous cognitive and psychomotor domain into eight broad domains with sub domains. Each domain has specific competencies and can be found in Table 5.

Table 5

Athletic Training Education Competency Domains

Domain	Sub Domain
Evidence-Based Practice (EBP)	
Prevention and Health Promotion (PHP)	General Prevention Principles Prevention Strategies and Procedures Protective Equipment and Prophylactic Procedures Fitness/Wellness General Nutrition Concepts Weight Management and Body Composition Disordered Eating and Eating Disorders Performance Enhancing and Recreational Supplements and Drugs
Clinical Examination and Diagnosis (CE)	
Acute Care of Injuries and Illnesses (AC)	Planning Examination Immediate Emergent Management Immediate Musculoskeletal Management Transportation Education
Therapeutic Interventions (TI)	Physical Rehabilitation and Therapeutic Modalities Therapeutic Medications
Psychosocial Strategies and Referral (PS)	Theoretical Background Psychosocial Strategies Mental Health Referral
Health Care Administration (HA)	
Professional Development and Responsibility (PD)	
Clinical Integration Proficiencies (CIP)	Prevention & Health Promotion

NATA Executive Committee for Education (2011). Athletic Training Education Competencies, 5th Ed. National Athletic Trainers Association. pp.1-32.

Every five years the Board of Certification (BOC) conducts a role delineation study (RD) to determine the skills necessary for athletic trainers to possess. The RD is used not only as a guide for all athletic trainers but more importantly is used as a blueprint by the BOC for construction of the certification

examination. The BOC is an independent company responsible for insuring athletic trainers meet entry level standards thereby insuring competency prior to practicing health care to the public.

History of Clinical Education in Athletic Training

Clinical Education is a significant portion of the professional preparation of students enrolled in fields of Allied Health including athletic training. The history of athletic training clinical education is borrowed from other medical educational processes. Clinical education has its formal roots in medical education in which medical schools used an apprenticeship model (Weidner & Henning, 2002). This apprenticeship was advocated by Dr. William Osler who wrote about the *natural way of teaching* in which he stressed the concept of education starting with the patient, continuing with the patient, and ending with the patient (Osler, 1928). This was the guiding principle in medical education and one the early athletic training educational efforts adopted. Early athletic training education programs utilized an apprenticeship model which required the student to acquire 1,500 hours of practical experiences from a certified athletic trainer (Delforge & Behnke, 1999). Students were expected to learn athletic training skills in a practical setting versus a classroom. Students learning experiences were limited to what activities were taking place in a particular athletic training room and the knowledge of the mentor.

As medical education shifted to a competency based approach and with it the shift in requirements of the practicing professionally, problems soon developed. By the mid 19th century educators reported a disparity in uniformity

among the preceptors (practitioners acting as clinical instructors). In 1847 the medical establishment determined that the preceptoral system of training was in need of review (Weidner & Henning, 2002). By 1910 the core of medical education was the basic sciences but very little had been done to reconceptualize clinical education (Ludmerer, 1985). Clinical education consisted of 8-10 students in groups spending 1 or 2 hours a day observing patient care in the hospitals but the students were not actively involved (Ludmerer, 1985). A clerkship model of instruction was soon introduced which encouraged the student to be actively engaged in the learning environment. Under this system the students not only received instruction at the hospital by more experienced physicians but became working members of the hospital (Ludmerer, 1985).

As students became more and more involved with the function of a hospital the relationship between schools and hospitals became strained. Hospitals would tolerate students in their environment if there were standards and the students did not interfere with the working of the hospital (Ludmerer, 1985). Maintaining a healthy relationship between school and clinical site is still as important today as it was in the late 1800's (Weidner & Henning, 2002).

The application of knowledge and skills, to actual practice on patients has been a component of athletic training since its inception. However, planned intentional clinical education was not included in early athletic training standards. Athletic training education programs formally included clinical education as a part of their curriculum in the mid 1970's (Weidner & Henning, 2002). At this time the

clinical component of athletic training education was not that different from the clerkship model in medical schools.

Much can be learned from the review of the development, maturation, and analysis of clinical education and how it relates to students learning and professional development. It is imperative to provide a greater depth and breadth of the clinical education components of formalized athletic training education programs, prior to analyzing critical thinking in this specific environment. Clinical education offers opportunities for the student different from the traditional classroom and the exploration into critical thinking in that context could be beneficial.

The first *Competencies in Athletic Training* was not developed until 1983 by the PEC (Weidner & Henning, 2002). This was a huge leap forward in promoting the development of a competency-based approach to athletic training education. The Competencies in Athletic Training represent the most significant and largest portion of the guidelines in place for athletic training education programs in the United States and were formed by the first role delineation study. The NATA in conjunction with the BOC in 1982 formed the first task force to create the role delineation study which delineates the competencies formed on the basis of what is needed in the field. The role delineation is updated every five years and is still in use today. This provided the subject matter requirements that would help make athletic training education programs truly competency-based (Weidner & Henning, 2002).

Current Trends in Clinical Education

Clinical education in Allied Health professions has become much more standardized, structured, and organized in recent years through all professions (Weidner & Henning, 2002). This has allowed for more focused learning and increased measurability of learning progressions as compared to unmeasured learning. Responsibilities of the student, clinical instructor, program director and the school have become more defined. Clinical education relies on this tripartite relationship between students, clinicians, and academic staff (Cross, 1995). Prior to the realization of the importance of these three variables the socialization into the athletic training profession appeared to be the most important function and there was less focus on competencies of athletic training (Weidner & Henning, 2002). This socialization is important for new athletic trainers to feel as if they are part of this shared cultural group. The values, attitudes, actions, and interests are important to learn, however these did not address the needs of the learner to be a skilled and competent health care provider. Education and socialization are seen as identical to some and much different to others. Framers of allied health education at the end of the twentieth century saw these two domains as completely separate.

It is well documented that during clinical education if the allied health students do not feel as if they are receiving appropriate attention and direction feel they are exploited as a work force (Harris & Naylor, 1992). Today's athletic training students receive close supervision during their clinical education which focuses more on competencies and less on socialization. Knight (1990), was the

first to write a complete text on the structure of competencies and proficiencies to be obtained during clinical education. Knight utilized a modular approach to organize these experiences. Since then 12 different athletic training clinical education setting standards have been developed (Weidner & Laurent, 2001). Today, athletic training educators have formalized documents that clearly define the standards and reflect specific evaluative forms to insure all students are learning specific skills during their clinical education. Thus, the clinical education experience students receive today is intentional and systematic. This experience demonstrates a focused measure of students' skill progression as compared to the situational learning that was occurring during the internship or apprenticeship experiences.

Other current trends that have significantly altered clinical education are the issues of public accountability, credibility, cost containment, outcome measurements and service orientation in allied health (Weidner & Henning, 2002). These global changes in society have resulted in some athletic training educators advocating for an early introduction into clinical experiences. This early exposure to clinical education is earlier than most allied health professions. The disadvantage to earlier placements was placing students in a situation to provide health care without having the technical knowledge to provide safe and effective care. Therefore the need to provide constant and immediate feedback and support to the students increased. The literature supports the need for immediate feedback during clinical education. However, this takes time away from direct patient care for clinical instructors and could become cost prohibitive. Most

clinical instructors employed as athletic trainers to provide a service to patients and are functioning as educators as a service to the profession. The majority of clinical sites in the early 21st century lacked the human resources to provide this type of support to the student. This was the same concern medical schools dealt with during their formative years during the 1970's. As athletic training education grows we may experience an increase in monies spent by institutions of higher learning to support the need for more clinical instructors to give the athletic training students the time they require.

Clinical Supervision

Approved Clinical Instructors (ACI) or Preceptors are an integral variable as to the quality of athletic training education. Athletic training students perceive 53% of their athletic training development comes directly from their clinical education (Laurent & Weidner, 2001). The attributes of good clinician instruction are dependent upon the environment and what is needed in that context.

Students are varied and enter clinical education at different levels of understanding. Harden, Crosby, Davis, and Friedman (1999) refer to a three circle model to depict the different abilities of athletic training students and the need to meet the student where they are. This three circle model is reminiscent of Howard Gardner's Theory of Multiple Intelligence in which he advocated for the understanding of educators that students hold many several forms of intelligence. Gardner believes there exists a multitude of intelligences, quite independent of each other, and each intelligence has its own strengths and constraints.

Specific standards have been published with their subsequent criteria that delineate what an effective ACI looks like. Weidner & Henning (2004) published the following list of Standards for ACI's in Table 6.

Table 6

Standards for ACI's

<i>Standard</i>	<i>Description</i>
<i>Legal and Ethical Behavior</i>	<i>Comply with the NATA Code of Ethics and BOC Standards of Professional Practice</i>
<i>Communication Skills</i>	<i>Communicate effectively with the Program Director and/or Clinical Education Coordinator and athletic training students.</i>
<i>Interpersonal Relationship</i>	<i>Enter into positive and effective interpersonal relationships with students, including being a role model and mentor</i>
<i>Instructional Skills</i>	<i>Demonstrate effective instructional skills during clinical education, including a basic knowledge of educational principles</i>
<i>Supervisory and Administrative Skills</i>	<i>Provide the right type, amount, and quality of clinical supervision and uphold the clinical education policies, procedures, and expectations of Athletic Training Education Program</i>
<i>Evaluation of Performance</i>	<i>Inform student of the strengths and weaknesses of their clinical performance</i>
<i>Clinical Skills and Knowledge</i>	<i>Demonstrate appropriate clinical competence in the field of athletic training through sound evidence based practice and clinical decision-making</i>

From: Weidner, T. G. & Henning, J. M. (2004). Development of Standards and Criteria for The Selection, Training, and Evaluation of Athletic Training Approved Clinical Instructors. *Journal of Athletic Training*, 39(4) 335-343.

These best practices are considered universal and can be utilized by athletic trainers who are serving or about to serve as ACI's in many different clinical settings. Approved clinical instructors can utilize these standards to self assess their clinical instructor ability (Weidner & Henning, 2005). The Legal and

Ethical standard is centered on the NATA Code of Ethics and the BOC Standard of Professional Practice.

Critical Thinking in Athletic Training

Athletic training education is a relatively new member of allied health as compared to other occupational preparations in the medical and nursing fields. Athletic training education is a competency-based curriculum intended to prepare the entry-level athletic trainer. These competencies are intended to identify and encompass Bloom's Taxonomy and therefore learning is expected to occur in a stage like process over time. As mentioned, nursing and medical literature is saturated with pre and post testing of critical thinking but no such literature is available in athletic training. Critical thinking in allied health education focused on differences between entry and exit points and relationships between clinical decision making and critical thinking (Swiger, 2005). There has been research exploring the athletic training student's predisposition to critical thinking (Leaver-Dunn et al, 2002), however Leaver-Dunn and her research team did not explore critical thinking skills.

Fuller (1997) was the first from the field of athletic training education to address critical thinking. The purpose of his study was to determine if athletic training educators were writing learning objectives that fostered CT in their students. Fuller defined critical thinking as the top four levels of Blooms Taxonomy. Fifty-two percent of the sixty-four syllabi from thirty athletic training programs included in the study revealed to have learning objectives written on their syllabi that mentioned critical thinking. Similar numbers were found in the

nursing literature. Fuller examined three different levels of students in undergraduate athletic training education programs. Basic level or sophomore levels syllabi indicated 51% of objectives focused on critical thinking, 54% of junior level, and the top tier or senior level 48% (Fuller, 1997). The lack of critical thinking objectives may indicate many educational programs advertise critical thinking but in only half of the cases are the learning objectives constructed in a way that critical thinking is intentional.

The second question Fuller was attempting to answer was whether written assignments and written examinations in athletic training education programs were measuring critical thinking skills. Fuller reported 86% of the 3,215 exam questions analyzed were not classified as promoting critical thinking. The results indicate educational objectives intended to foster critical thinking are much higher than the assessment methods used most commonly in athletic training education. Only 143 written questions were submitted from the 81 examinations and all of them were classified as promoting critical thinking. This is reflective of Walkers study (2003) in which she advocated for the utilization of written assignments to promote critical thinking among students.

The greatest challenge of health professions education is to produce professionals who are capable of critical thinking (Heinrichs, 2002). As a result there is a need for instructional strategies to promote critical thinking. Knight (2008) explicitly advocated for educators to purposefully teach and practice critical thinking skills with their students. However, only a few authors have addressed critical thinking specific to the field of athletic training education.

Walker (2003) provided various strategies in athletic training education, to promote critical thinking. Teachers need to engage in and students must be exposed to a broad spectrum of teaching methodologies and assessment strategies in order to allow for critical thinking (Walker, 2003). Walker identified three broad mechanisms to promote CT: questioning, discussions, and written assignments should all be utilized in the classroom (Walker, 2003).

One of the teaching methods promoted to enhance critical thinking in athletic training education is problem based learning. Problem based learning is common in medical and allied health education. It has been advocated by Heinrichs (2002) to use problem-based learning for the development of critical thinking in athletic training education. Problem-based learning (PBL) is an educational method characterized by the utilization of patient problems as a context for problem solving (Finucane, Johnson, Prideaux, 1998). PBL originated in medical education and is promoted by many in the field to help promote clinical decision making (Walker & Leary, 2009). However clinical decision making is not synonymous with critical thinking. Swiger (2005) dissertation failed to demonstrate a significant correlation with decision making skills and students critical thinking skill. Problem-based learning allows for the blending of basic science, psychomotor skills and clinical reasoning in the context of clinical practice (Heinrichs, 2002). PBL is underpinned by cognitive psychology and adult education theory of Malcolm Knowles (Finucane, Johnson, Prideaux, 1998). Heinrichs (2002) acknowledges students' problem solving skills increased while engaged in PBL, however he did not measure critical thinking skill. Heinrichs

exploration into critical thinking overemphasized clinical decision making and not critical thinking, therefore not truly studying critical thinking. The premise of her article was centered on the PBL being common in medical education (Heinrichs, 2002). Heinrichs (2002) advocated for PBL, because it would aid in development of athletic training students ability to critically think and problem solve. Swigers work in 2005 disagrees. Problem solving or clinical decision making is using algorithms in a linear way. This is much different then the recursive, inductive, deductive and metacognitive premise of critical thinking.

The other notable study exploring critical thinking in athletic training education was done by Leaver-Dunn et al. (2002). They measured undergraduate athletic training students' predisposition to critical thinking versus their skill, and attempted to provide correlations to specific demographic and educational variables. Results revealed a small inclination towards critical thinking but the tendency was relatively weak. No significant relationship was found between score and age, sex, ethnicity, cumulative grade point average, completed semester hours or clinical-experience hours. This is consistent with the work by Facione, Facione and Giancarlo (1997) which found no difference in total dispositional scores between the sexes.

The research revealed a weak score in the truth-seeking subscale and contributed this to the nature of athletic training education programs being competency-based. Students are expected to and taught to find the right answer as opposed to considering an alternative response (Leaver-Dunn et al., 2002). This is consistent with what Profetto-McGrath et al. (2003) found in truth seeking

scores of nurses. Colucciello, (1997) also found a significantly weak sub score of truth-seeking. Both athletic training and nursing education are types of educational programs underpinned by western medicine which holds the philosophical assumption of determining truth by measuring, evaluating, and experiencing. The environment of these types of educational programs may not foster critical thinking and is in conflict with the APA definition of critical thinking.

Summary

Critical thinking has a rich and expansive history and many in education and allied health have studied critical thinking. Noting the importance of critical thought from Socrates up to present day, critical thinking has a long narrative in the construction of modern day higher education. The literature review highlights the experts in the critical thinking field, Dewey, Paul, Ennis, Beyer, McPeak, Brookfield, Mezirow and Facione.

As the literature review revealed, a depth and breadth of research on critical thinking has been applied to fields similar to athletic training. Allied health, nursing, and medical fields all have vast amounts of data on critical thinking in their respective domains, with nursing being the most prominent. Athletic training has very little and, therefore, it is imperative that an investigation into this area occurs.

Modern day athletic training education, although building upon older medical education models, is a relatively new profession. Critical thinking is an essential competent in allied health and athletic training is a member of the allied health paradigm. As athletic training matures and subsequently the process of

educating future athletic trainers evolves, it is essential educators continue to meet the needs of the students. The construction of the athletic training education process will continually be scrutinized as the professionals attempt to find the right path for educating the future athletic trainers. One of the questions that must be answered is to determine if a difference exists in undergraduate versus graduate level athletic training students' critical thinking skill. This information will guide athletic training educators in determining at what level we should be constructing educational programming. Finally, it will be necessary to identify the variables students perceive that have influenced their ability to critically think.

CHAPTER III

METHODOLOGY

The purpose of this chapter is to provide a description of the methods and instruments utilized in this study. The chapter is divided into the following categories: research design, method which includes definition of the population, sampling procedures, instrumentation and explanation of the validity and reliability of the instruments, as well as a description of the analysis of data. In addition, this chapter will provide a thorough explanation of the procedures used to explore the second research question.

The purpose of the study was to investigate the potential difference in critical thinking skill between undergraduate and graduate level athletic training students. Secondly, this investigation explored the components of athletic training clinical education that an athletic training student recognizes or perceives as having an impact on their critical thinking skill. This investigation is specific to both sample undergraduate and graduate students enrolled in a CAATE accredited athletic training education programs and are in their final year of preparation for the BOC examination.

Research Design

The research design was a non-experimental comparative study to examine the presumed effect of education level on students' critical thinking skill. The central thesis of this study was that a difference in critical thinking skill may have been occurring at different levels of athletic training education. This idea has some conflicting results in the literature and was in need of further empirical

investigation. Quantitative data were collected from the CCTST-2000. The CCTST-2000 subscale scores were assigned as dependent variables and the students' current level of education was assigned as independent variables for empirical analysis.

To answer research question one an associational approach was utilized to investigate the relationships between athletic training students' level of education and their measured skill in critical thinking. Data was collected through an on-line critical thinking skills test. The on-line test was the California Critical Thinking Skills Test 2000 (CCTST 2000) and allowed for demographic information of the participants to be collected concurrently. Associational approach in research is utilized when an investigator seeks to identify cause and affect relationships by forming groups of individuals (Gliner, Morgan, & Leech, 2009). The independent variable (level of education) was associated against the dependent variable (test scores). This study was considered both an associated and comparative study as it only attempted to find the strength of relationships. This investigation was not intended to discover true causation. Therefore, this study does not have any direct threats to internal validity. Pre and post testing was not performed. A key factor in comparative and associated studies is to form appropriate comparison groups (Gall, Gall & Borg, 2007). For this study the two groups, undergraduate and graduate students, were self formed and made for a more efficient analysis of the dependent variable.

To answer the second research question a qualitative approach was used. Participants were asked open-ended questions in regards to their critical thinking.

Identifying the components of athletic training clinical education that an athletic training student recognizes or perceives as helpful in increasing their critical thinking skill requires an inductive approach to data collection. A qualitative method is necessary when important variables are not known (Creswell, 2009, p.18). In order to achieve a deeper and richer meaning of the experience in which critical thinking may or may not occur a qualitative paradigm is needed. Questions drive the methods and the second research question is inductive in nature. According to Blakie (2010) qualitative research starts with the collection of data and then proceeds to generalize using inductive logic. This inductive process can *build* from data broad themes to a generalized model, to give insight as to what is occurring in certain situations (Cresswell, 2009). To determine if differing experience exist between these two groups the study focused on the students' clinical education experience. The intent of this study was to gain a greater understanding of a potential difference between ELM students and UG students specific to clinical education.

Participant Selection

The participants were students enrolled in their final year in a CAATE Accredited Athletic Training Education Program including bachelor and entry level master programs. All students sampled were expected to be graduating within one year from their participation and eligible to sit for the BOC examination. This removed variation in scores that may have been caused by level within each academic program.

After IRB approval was granted a list of the 26 entry level master programs was obtained from the Commission of Accreditation of Athletic Training Education website on May 20, 2012. These 26 programs constituted the target population. Letters of invitation to participate in this study were mailed to all 26 program directors of the respective entry-level master programs therefore all 26 programs had equal opportunity to participate. Ten programs from each level was determined to provide a sufficient sample for external validity, while remaining a feasible number to study in terms of researcher costs of purchasing the instrument. The first 10 of the 26 entry level master programs to respond were included in this study.

To select a matching set of 10 undergraduate programs a list of 343 undergraduate accredited programs from the Commission of Accreditation of Athletic Training website on July 25, 2012 was obtained. Utilizing the Carnegie Classification of Institutions of Higher Education, twenty six undergraduate programs were purposefully selected for invitation to participate.

The Carnegie Classification criteria utilized for matching was four different criteria. The level of control, undergraduate instruction programs, graduate instructional programs and overall enrollment profile were used for matching purposes. Control classifications designate schools as either Private not-for profit, Private for Profit or Public institutions. All schools in this study were either Private not-for profit or Public institutions. The Undergraduate Instructional Program classification is essential in labeling what most college's and universities do as the majority of them teach undergraduate students (Carnegie

Foundation for the Advancement of Teaching, 2012). The undergraduate classification is based on three pieces of information: level of undergraduate degrees, proportion of bachelor's degree majors in arts and sciences to degrees in professional fields. In addition the extent to which an institution awards graduate degrees in similar fields as it awards undergraduate degrees. The Graduate Program classification in comparison examines the nature of graduate education with a special focus on the mix of graduate programs across fields of study (Carnegie Foundation for the Advancement of Teaching, 2012). The classification is based on the level of graduate degree awarded (masters and doctoral categorized as either research, professional, or doctorate), the number of fields represented by the degrees awarded, and the mix of concentration of degrees. Enrollment Profile provides a snapshot of the student population by grouping institutions according the mix of students enrolled at the undergrad and graduate levels. Range of Profile designation is found in table 7

Table 7

Enrollment Profile Classification

<u>Very high undergraduate</u>	Fall enrollment data show both undergraduate and graduate students, with the latter group accounting for less than 10 percent of FTE
<u>High undergraduate</u>	Fall enrollment data show both undergraduate and graduate students, with the latter group accounting for 10–24 percent of FTE enrollment.
<u>Majority undergraduate</u>	Fall enrollment data show both undergraduate and graduate students, with the latter group accounting for 25–49 percent of FTE enrollment.

From: Carnegie Foundation for the Advancement of Teaching. (2012). *The Carnegie Classification of Institutions of Higher Education; Classifications*. Retrieved July 24, 2012 from www.carnegiefoundation.org/classifications/index.asp

The ten entry level masters programs included were entered into the Carnegie Classification database on-line. Utilizing the four characteristics, the on-line database provided a list of matching schools that had all four of the same characteristics. The list of schools obtained from the CAATE website was cross-referenced and three schools were purposefully selected from each list. The thirty schools identified as having matched entry level master Carnegie classifications were invited to participate. Letters were mailed to the program directors of all thirty undergraduate programs requesting their assistance in soliciting student participation. A reminder email was sent four weeks after the mailing. The first ten programs to respond were included in testing. Both entry-level master and undergraduate program directors were asked to provide me a number of eligible students for inclusion. One hundred seventy-four students were identified for inclusion. A total of 82 participants and 20 schools were included in this study (Table 8). Gall, Gall and Borg (2007) recommend a minimum of 30 participants for correlational research; therefore, 82 subjects provided a sufficient sample size to investigate the research question.

Table 8

Participating Schools Carnegie Classification

College	Control	Undergraduate Programs	Graduate Programs	Enrollment Profile	Matching ELM
ELM 1	Private not-for profit	Professions plus arts & sciences, some graduate coexistence	Postbaccalaureate with arts & sciences	High undergraduate	
ELM 2	Private not-for profit	Professions plus arts & sciences, some graduate coexistence	Postbaccalaureate professional	Very high undergraduate	
ELM 3	Private not-for profit	Professions plus arts & sciences, some graduate coexistence	Doctoral professional dominant	Majority undergraduate	

ELM 4	Public	Balanced arts & sciences/ professions, some graduate coexistence	Postbaccalaureate with arts & sciences (education dominant)	Very high undergraduate	
ELM 5	Public	Professions plus arts & sciences, some graduate coexistence	Comprehensive doctoral	Very high undergraduate	
ELM 6	Private not-for profit	Professions plus arts & sciences, some graduate coexistence	Comprehensive doctoral	Majority undergraduate	
ELM 7	Private not-for profit	Balanced arts & sciences/ professions, some graduate coexistence	Doctoral professional dominant	Majority undergraduate	
ELM 8	Private not-for profit	Balanced arts & sciences/ professions, some graduate coexistence	Doctoral professional dominant	Very high undergraduate	
ELM 9	Public	Professions plus arts & sciences, high graduate coexistence	Comprehensive doctoral	High undergraduate	
ELM 10	Public	Balanced arts & sciences/ professions, some graduate coexistence	Doctoral professional dominant	High undergraduate	
College	Control	Undergraduate Programs	Graduate Programs	Enrollment Profile	Matching ELM
UG 1	Private not- for profit	Professions plus arts & sciences, high graduate coexistence	Doctoral professional dominant	Majority undergraduate	ELM 3
UG 2	Public	Professions plus arts & sciences, high graduate coexistence	Comprehensive doctoral	High undergraduate	ELM 9
UG 3	Public	Professions plus arts & sciences, some graduate coexistence	Comprehensive doctoral	Very high undergraduate	ELM 5
UG 4	Public	Balanced arts & sciences/ professions, some graduate coexistence	Doctoral professional dominant	Very high undergraduate	ELM 8
UG 5	Private not- for profit	Professions plus arts & sciences, some graduate coexistence	Postbaccalaureate with arts & sciences	High undergraduate	ELM 1
UG 6	Public	Balanced arts & sciences/ professions, some graduate coexistence	Doctoral professional dominant	High undergraduate	ELM 10
UG 7	Public	Balanced arts & sciences/ professions, some graduate coexistence	Postbaccalaureate with arts & sciences (education dominant)	Very high undergraduate	ELM 4
UG 8	Public	Balanced arts & sciences/ professions, some graduate coexistence	Postbaccalaureate with arts & sciences (education dominant)	Very high undergraduate	ELM 4
UG 9	Public	Professions plus arts &	Comprehensive	High	ELM 9

		sciences, high graduate coexistence	doctoral	undergraduate	
UG 10	Public	Balanced arts & sciences/ professions, some graduate coexistence	Postbaccalaureate with arts & sciences (education dominant)	Very high undergraduate	ELM 4

All CAATE accredited programs meet acceptable educational standards for professional practice for the entry-level athletic training education (CAATE, 2011). However, the three-hundred sixty-nine accredited programs do differ in scope and mission. The Carnegie Classification system is widely used in research of higher education as a way to describe institution diversity. Developed in the 1970's the Carnegie Classification helps control for institutional differences, and also aids the researcher in selecting adequate representations of sampled institutions (Carnegie Foundation for the Advancement of Teaching, 2012).

Instrumentation

The California Critical Thinking Skills Test Form 2000 was purchased from California Academic Press, Millbrae, CA. An electronic version (e-test) of the CCTST 2000, produced by Insight Assessment, was utilized for the quantitative and qualitative data collection. This instrument is based on the APA Delphi conceptualization of critical thinking, consisting of a 34 multiple choice test designed for evaluating the critical thinking skills of college students (Facione, Facione, Blohm, & Giancarlo, 2002). The CCTST 2000 is an updated version of the CCTST Form A and Form B, both of which have been used since 1994. The CCTST 2000 provides a broad representation of critical thinking skills and has shown to be an improved and more robust tool to measure critical thinking skills

(Facione et al., 2002). The test is designed to assess overall critical thinking skills on the following five critical thinking subscales: analysis, evaluation, inference, deductive, and inductive reasoning. Each answer was scored dichotomously, i.e., a 1 for a correct response and all other responses received a 0. The CCTST has proven to provide a 82% rate of internal consistency making this exam reliable (Facione, 2001). Creswell (2009) supports the utilization of electronic testing as an easy and effective method of data collection. In addition, demographic information was collected on each participant. Educational level of current student, gender, ethnicity and age was collected using the CCTST 2000 on-line e-test. The following three open ended questions were included to provide data to answer the second research: What are the components of athletic training clinical education that an athletic training student recognizes or perceives as helpful in increasing their critical thinking skill in both undergraduate and graduate level students?

1. What does critical thinking mean to you?
2. Is critical thinking important for athletic trainers in clinical education and why?
3. What has influenced your ability to critically think in clinical education?

Students' scores are secured on a server owned by Insight Assessment.

In order to protect the subjects' confidentiality, the results are password protected and encrypted. The first research question explored the potential difference between CCTST 2000 scores and the academic level of education. Raw scores

were entered into SPSS version 17 and both descriptive and inferential statistics were performed.

Validity of Instrument

Validity in testing is the measure of appropriateness, meaningfulness, and usefulness of a specific inference of a test score (Gall, Gall & Borg 2007). It is critical the instrument selected for measurement is valid in order to allow for overall validity in the study (Gall, Gall & Borg 2007). The CCTST has been shown to be a valid and reliable measure of college students' six cognitive skills as defined by the Delphi panel (Facione, 1990). Specifically, the CCTST has demonstrated content validity by matching items on the test with their relationships to the domain of critical thinking as defined by the Delphi definition. All items on the test are discipline, gender and social class neutral to avoid any bias (Facione et al., 2002). Criterion validity refers to the ability of the metric to predict some criterion external to the test itself (Facione, 2012). This type of predictive ability has have been found with the CCTST (Facione, 2012). Criterion validity was established using college GPA, SAT and GRE scores (Facione et al., 2002). McCall, MacLaughlin, Fike and Ruiz, (2007), demonstrated a correlation with GRE Total score: Pearson $r=.719$, $p<.001$; GRE Analytic $r=.708$, $p<.001$; GRE Verbal $r= .716$, $p<.001$.

Reliability of Instrument

Reliability is the measure of consistency or stability of a test score (Gall, Gall & Borg 2007). The Kuder Richardson – 20 (KR-20) is a common statistical test used to establish internal consistency. The KR-20 is similar to Cronbach's

alpha but is favorable when dichotomously scored instruments and scales are used. The CCTST has met the threshold for internal consistency (Facione, 2012). Validation studies of the CCTST for college students utilizing the KR-20 have revealed .78 to .82. (Facione, 2012). Tests are considered to hold strong internal reliability when the KR-20 is .72 or higher (Facione, 2012).

Procedures / Data Collection

Institutional Review application for expedited review was submitted May 10, 2012. Data collection took place in the fall semester of the 2012-2013 academic years. Once Institutional Review Board (IRB) approval was granted and educational programs were identified. Letters of invitation to corresponding program directors were mailed. Program directors either called or emailed their willingness to help recruit students and indicated how many students they currently had enrolled in their last year of the program. The maximum number of CCTST-2000 exams were purchased from insight assessment (n=174). Consent forms for both undergraduate and entry level master students (Appendix B.1, B.2) and test-taker instructions for online testing of the CCTST were mailed to program directors October 3, 2012. The consent form included a brief explanation of the study, the participant's rights, risks and benefits and contact information of the researcher. Willing participants were not required to sign the consent form or return it as their completion of the on-line exam provided their consent. A uniform set of written instructions carried out by each participating school is necessary to increase reliability of test scores. Phone calls were made

to all twenty program directors of participating schools to address any questions or concerns.

Program directors at the participating institutions were responsible for arranging testing dates and times in addition to securing a location for testing. Program directors provided administration and monitoring of the testing process and provided written instructions of how to access and complete the exam (Appendix 3). Each institution was given a specific login and password to access the CCTST 2000 on-line test. Once participants were logged on they had the option of creating their own unique UserID and Password for returning access to the site or utilizing the UserID and Password provided. Participants were required to fill in demographic information on the profile page including ethnic identification, gender, age and current school of enrollment.

To insure confidentiality participants were asked to type in their respective institutions name in the "*Name*" place on the form. After login and profile questions the participants selected the CCTST and proceeded to the e-test. A maximum 45 minutes was allowed for test completion. Questions not completed within the 45 minutes were scored as zero. At the conclusion of the test, participants' results appeared on the screen and they were given the option to either print out their results or log out of the system. All scores and demographic information were secured and encrypted on Insight Assessment website.

Data Analysis

The variables analyzed in this study were critical thinking total scores and subs-scale scores, level of education (entry-level masters, undergraduate),

gender, ethnicity and age. The first research question explored the potential differences in critical thinking scores and current level academic preparation to become an athletic trainer. The CCTST 2000 provided an overall critical thinking skill scores as well as five critical thinking subscale scores (analysis, evaluation, inference, deductive and inductive reasoning). Raw scores were entered into SPSS version 18 and descriptive statistics were utilized to provide a mean, and standard deviation score.

To determine if a difference existed between the two academic levels and critical thinking scores a one-way multiple analysis of variance (MANOVA) was conducted. Demographic information was gathered and analyzed. Analyzing other variables such as demographics was essential to help investigate potential differences in critical thinking skill between entry level masters and undergraduate athletic training students. Ethnicity, gender and age were all provided in the personal profile section. A point biserial correlation coefficient was utilized for correlational analyses of both ethnicity and gender with critical thinking skill. The Pearson Product Moment Correlation was used for the correlational analysis of age and critical thinking skill score. A two-way analysis of variance (ANOVA) was conducted as an additional follow-up test to the MANOVA and correlational analysis's.

Research question two was answered by the open-ended questions. Examination of answers resulted in themes emerging from the responses of question one, two, and three. Question four was simply tallied to determine what schools participated in the study. The first step in the analysis process was to

collect all typed responses provided by Insight Assessment, and match them with the corresponding questions. Responses were automatically separated between entry level master students and undergraduate students. All responses were marked with matching dots on the back as to ensure answers were not mismatched between the entry level master group and the undergraduate group. Responses were placed under a question heading on a piece of tag board. The questions were typed on the top of the board with clear dividers and responses were placed under the corresponding question.

The second step was to read all responses looking for key words and group responses by those commonalities. After the first grouping of responses, all answers were read again to look for units of general meaning. The process of reviewing responses for both common words and units of general meaning was a recursive process and was repeated until themes developed and the majority of responses were grouped. Responses were moved freely within the domain of the question until such a time that clear themes emerged. After several groupings were established outlier responses continued to exist. Responses were taped to the board and the theme was labeled.

The third step was to find an independent reviewer that was familiar with qualitative research and the field of athletic training education. The researcher met with the reviewer to discuss the process by which the questions were grouped and themes emerged. The reviewer took both boards with all responses grouped under corresponding questions and repeated the process of reading all responses, looking for areas of agreement and or discrepancies from the original

groupings. At the conclusion of the independent review a second meeting was scheduled to discuss the reviewer's findings. The reviewer confirmed the majority of the themes and a few of the differences were discussed and easily resolved. The labels of the themes were mutually agreed upon.

During the analysis process both themes and sub themes became apparent. This resulted in the development of either a single sub-theme or multiple sub-themes. For example, if a participants answer revolved around *providing good health care* but some responses specifically addressed the importance of *making a good diagnosis* versus others which centered on the importance *applying a skill*, two sub-domains were created under the theme of *providing good health care*. Whereas only one sub-theme developed under *preceptors*, some provided more detail in their answer as "being challenged by their preceptors". The last step in the analysis process was to write a summary of the findings and discuss the themes that emerged.

CHAPTER 4

RESULTS

This study investigated the relationship between critical thinking skills to athletic training education level. A review of literature indicated the CCTST 2000 to be the most commonly utilized test for measuring critical thinking skills in medical and allied health. In addition, the CCTST allowed for open-ended questions to be added to the instrument in order to customize the test and address both research questions in this study. Thus, the CCTST was selected for use in this study to measure critical thinking skill. Scores on the CCTST allowed for comparisons to be made between undergraduate and graduate athletic training students in overall critical thinking, as well as five subscale scores: analysis, inference, evaluation, induction and deduction. The first research question compared undergraduate athletic training critical thinking skill to entry level master critical thinking skill.

Of the 174 invited participants, 82 athletic training students participated in this study. Students represented five out of the selected ten entry level master programs and eight of ten selected undergraduate programs. Seven schools that were selected did not have any students complete the CCTST. As explained in Chapter 3 these programs had been selected using the Carnegie Classification of Institutions of Higher Education. Table 9 displays information regarding selected programs and participating students.

Table 9

Summary of Participants by Selected Program

Type	UG Programs	Grad Programs	Enrollment Profile	Entry Level Master Participants	Undergraduate Participants
Private not-for-profit	Professions plus arts & sciences, some graduate coexistence	Postbaccalaureate with arts & sciences	High undergraduate	6	8
Private not-for-profit	Professions plus arts & sciences, some graduate coexistence	Postbaccalaureate professional	Very High undergraduate	2	0
Private not-for-profit	Professions plus arts & sciences, high graduate coexistence	Doctoral professional dominant	Majority undergraduate	0	1
Public	Balanced arts & sciences/professions, some graduate coexistence	Postbaccalaureate with arts & sciences (education dominant)	Very high undergraduate	1	14
Public	Professions plus arts & sciences, some graduate coexistence	Comprehensive doctoral	Very High undergraduate	0	8
Private not-for-profit	Professions plus arts & sciences, some graduate coexistence	Comprehensive doctoral	Majority undergraduate	11	0
Private not-for-profit	Balanced arts & sciences/professions, some graduate coexistence	Doctoral professional dominant	Majority undergraduate	9	0
Public	Professions plus arts & sciences, some graduate coexistence	Doctoral professional dominant	Very High undergraduate	0	7
Public	Professions plus arts & sciences, high graduate coexistence	Comprehensive doctoral	High undergraduate	0	12
Public	Balanced arts & sciences/professions, some graduate coexistence	Doctoral professional dominant	High undergraduate	0	3

Of the 82 that participated, 53 were undergraduate and 29 were entry level master students. Participants were given 45 minutes to complete the on-line exam. All tests completed were included for analysis. Nine additional students began the exam, but either did not finish, or failed to indicate completion by

clicking “Done with test,” or logged off prior to the minimum time of fifteen minutes, indicating a non-effort.

Demographic information is displayed in Table 10. Participants were asked to identify their ethnicity, with 82% indicating White, Caucasian. Participants were also required to identify as male or female. Age ranged from 22 to 57 in the entry level masters population with an average of 24.51 years and 20 to 24 within in the undergraduate population with an average of 21.79 years.

Table 10

Summary of Participants Gender, Ethnicity, Age, by Group Membership

	Entry Level Masters	Undergraduate
<i>Gender</i>		
Females	19	33
Males	10	20
<i>Age</i>		
20-21	0	26
22-23	14	24
24-25	7	3
26-27	5	0
≥27	3	0
<i>Ethnicity</i>		
Caucasian/Anglo American	20	47
Latino/Mexican American	0	4
Asian American	2	1
Black African American	6	0
Other	1	1

Note. n=82

Research Question One Analysis

Research question one explored the difference in critical thinking skill score between undergraduate and entry level master athletic training students. The test publisher, California Academic Press, provided test results through a score report containing six scores for each student: an overall critical thinking skill score and five subscale scores. Scores are reported based on a 100-point

scoring metric. The mean score for entry level master students was 75.72 (SD=7.98). Table eleven summarizes the scores for these students. The critical thinking subscale where entry level master students received the highest score was induction (M=78.93, SD=7.33). See Table 11 for a summary of scores for the entry level masters students.

Table 11

Critical Thinking Overall & Subscale Scores for Entry Level Master Students

Scale	Mean	Standard Deviation	Minimum	Maximum
Total Score	75.72	7.98	62.20	90.20
Induction	78.93	7.33	63.60	89.60
Deduction	75.97	8.70	55.80	92.20
Analysis	77.93	10.66	60.00	95.00
Inference	78.37	8.40	60.80	91.60
Evaluation	72.71	8.07	54.90	87.70

Note. n=29

The average score for the undergraduate students in overall critical thinking was (M=73.14, SD 5.45). The undergraduate group also scored highest in the subscale of induction (M=77.04, SD= 5.39). Table twelve summarizes scores for the undergraduate students.

Table 12

Critical Thinking Overall & Subscale Scores for Undergraduate Students

Scale	Mean	Standard Deviation	Minimum	Maximum
Total Score	73.14	5.45	63.60	84.60
Induction	77.04	5.39	66.20	89.60
Deduction	73.07	6.67	61.00	89.60
Analysis	74.34	8.21	60.00	95.00
Inference	76.81	6.64	60.80	88.80
Evaluation	71.30	7.10	54.90	87.70

Note. n=53

Table thirteen summarizes the combined undergraduate and entry level master groups.

Table 13

Critical Thinking Overall & Subscale Scores for Undergraduate and Entry Level Master Participants

Scale	Mean	Standard Deviation
Total Score	74.05	6.53
Induction	77.71	7.17
Deduction	74.10	7.53
Analysis	75.61	9.24
Inference	77.36	7.30
Evaluation	71.80	7.44

Note. n=82

Correlational analyses were conducted using the three demographic variables and the critical thinking total score to determine if overall critical thinking scores were related to age, gender, or ethnicity. Utilizing the Bonferroni approach to control for Type I errors across the three correlations, a p value of less than .016 ($.05/3 = .016$) was required for significance. The Pearson Product Moment Correlation Coefficient was used for age as it provides a measure of the strength of relationship between two scale variables (Shavelson, 1996). A point biserial correlation was used for comparing both gender and ethnicity with critical thinking skill score. Point biserial correlation coefficient is appropriate when variables, such as ethnicity or gender are nominal. The results of the three correlational analyses suggest none of the demographic variables were significantly related to critical thinking skill score. Table 14 depicts the strength of relationships between critical thinking skill score and these demographic variables.

Table 14

Correlations Between Critical Thinking and Demographic Variables

	CCTST Score	p value
Gender	-.10	.35
Ethnicity	-.25	.02
Age	-.23	.04

Note. $n=82$

A one-way multiple analysis of variance (MANOVA) was conducted to determine if a significant difference exists between entry level masters and undergraduate students on the six dependent variables of induction, deduction, analysis, inference, evaluation and overall critical thinking skill score. MANOVA's are the appropriate statistical test when analyzing for significant difference between group means while accounting for multiple dependent variables. (Green & Salkind, 2008). No significant difference was found between the entry level masters and undergraduate athletic training students on the total or subscale scores, Wilks's $\Lambda = .90$, $F(5, 76) = 1.66$, $p > .16$. The multivariate η^2 based on Wilkes's Λ was weak, .10, indicating 10% of multivariate variance of the dependent variables is associated with the group factor. The results of the ANOVAs produced by this multivariate general linear model procedure were consistent with the non-significant Wilkes Λ ; the non significant F values from these ANOVAs are reported in Table 15. Collectively, the results suggest education level entry level did not have an effect on critical thinking, nor any of the subscales of critical thinking.

Table 15

*ANOVA Results from the Multivariate
Analysis of the Overall Critical Thinking Score and Five Subscale Scores*

Scale	df	F	p	partial eta squared
Overall	1,80	3.00	.09	.04
Induction	1,80	1.78	.19	.02
Deduction	1,80	2.86	.10	.03
Analysis	1,80	2.90	.09	.04
Inference	1,80	.86	.37	.01
Evaluation	1,80	.67	.41	.01

A two-way analysis of variance (ANOVA) was conducted as an additional follow-up test to the MANOVA, in light of the demographic variable, ethnicity, having a correlation with overall critical thinking score that approached significance ($p=.02$, compared to $.05/3$ or $.016$). In this two-way ANOVA, the factors were ethnicity and group, allowing for testing of the significance of either factor, as well as a potential interaction effect. The results indicated no significant interaction between ethnicity and level of education, $F(2,74) = .75$, $p=.48$. The main effects of ethnicity and level of education were also non significant, $F(4,74) = 2.16$, $p=.08$ and $F(1,74) = .59$, $p=.44$ respectively. This suggests that even when taking into account ethnicity, level of education does not appear to be related to critical thinking skill score.

In summary, these analyses suggest level of education did not have a significant effect on critical thinking or subscales of critical thinking. In addition gender, ethnicity and age were not related to critical thinking skill score.

Research Question Two Findings 1. What does critical thinking mean to you?

Due to the varying definitions of critical thinking found in the literature it was necessary to explore how these groups defined critical thinking. Themes that emerged in response to this question and were consistent for both groups were *analyzing data, problem solving, decision making* and ways of *thinking*. A unique theme to the entry level master group was that of *processing information*, and *evaluating information*. Specific responses in that theme were “specific evaluation of a particular subject” and another was “it means to assess situations and circumstances with a different perspective than normal.” Both suggest the understanding that critical thinking is partially an evaluative process. Unique to the undergraduate group was the theme of *application of a skill* and the sub-domains of *thinking outside of the box*. In both groups *thinking* was found as a theme, however, the entry level master group was 10% as compared to the undergraduate group at 21%. The responses all included thinking at an advanced level or a deeper level. Both groups’ responses represent an acknowledgement of critical thinking to be a higher form of thinking however, the undergraduate group formed relatively robust themes of both *thinking on your feet* and *thinking outside the box*. Thinking on ones feet suggests an immediateness of a decision being made with little time for a higher order process to occur. Participants defined critical thinking to be “thinking on your feet about a situation that is not common and coming up with an appropriate solution” or “the ability to troubleshoot a situation” or finally, “critical thinking means that you are able to think on your feet and adapt to the situation”. As mentioned ways

of *thinking* was a common theme for both groups, however the level of detail and explanation was greater in the entry-level master group as compared to the undergraduate group.

The three other common themes of *analyzing data*, *problem solving*, and *decision making* shared some commonalities and some differences. *Analyzing data* was the strongest theme for entry level master students, representing 24% of the respondents. *Problem solving* was second strongest at 21% followed by *decision making* at 21% of respondents. The undergraduate group answered *problem solving* to be the strongest at 15% of participants followed by both *analyzing data* and *decision making* at 11%. *Decision making* and *problem solving* both suggest an outcome to ones thought process. The theme of *analysis* reveals a process of thought that occurs. Entry level master students revealed the largest percentage of response grouping in that theme. *Thinking of all possibilities* and ability to *analyze all information* were common answers for entry level master students. Neither group demonstrated over a 50% agreement as to how to define critical thinking.

Research Question Two Findings 2. Is critical thinking important for athletic trainers in clinical education?

Consistent between both undergraduates and masters students was agreement on critical thinking being important for athletic trainers in clinical education with 100% of participants saying “yes.” The perception of why it is important lacked the congruence however, between groups of respondents. Only three themes emerged for the entry level master students. *Decision making* at

35% and the importance of *providing good health care also at 35%* were the two most robust, of the entry level master participants. Ten of the twenty-nine responses from the entry level master group made reference to the importance of athletic trainers “making decisions”. Another strong theme was the acknowledgement of the importance of *providing good health care*. However, in this theme two sub-themes emerged. Students perceived the importance of critical thinking under *providing good health care* as either the need to *make a good diagnosis* for example, as one student commented “Yes, because athletic trainers need to be able to use the clues and important pieces of information to come up with a diagnosis” or the specific *application of a skill*. For example, “Yes we need to apply skills and think in depth to figure out different pathologies”. Both are centered on providing care to a patient.

The third theme of the entry level master group was the belief that critical thinking occurs “outside of text books and traditional classrooms”. Twenty-eight percent of entry level master students’ answers were centered on learning outside of traditional educational materials. A student answered “Absolutely, we need to be able to critically think in each situation as each situation is different; not the textbook situations we may learn in class”. Another student answered “Yes, the job required us to be able to think critically and the solution is not always in a textbook”. Lastly a student answered “Yes, the practice of athletic training is not merely the regurgitation of facts from a book, and every scenario will be individualized”.

The undergraduate sample analysis revealed two identical themes to the entry level master sample. The reference to the importance of critical thinking to “decision making” and the imperative of “providing good health care” emerged. Critical thinking being linked to the ability to make decisions was represented in 15% of the undergraduate response as compared to 28% of entry level master group. “Providing good health care” was found in 21% of undergraduate as compared to 35% of entry level master. In addition, no sub-themes emerged within the undergraduate sample under the theme of “providing good health care”.

The most notable difference between the two groups was the theme of *adaptation* that emerged from within the undergraduate group. Thirty-two percent of undergraduates responding acknowledged the importance of adaptation with a sub theme of *adapting quickly*. An undergraduate student answered “absolutely, everyday is different from the previous so you have to be able to adapt and come up with a solution based on the circumstances”. Others within that group stressed the importance of adapting quickly “yes, athletic trainers get into positions where they have to adapt and usually quickly”. Lastly, 30% of undergraduate students made reference to “problem solving” as being the reason critical thinking is important. This theme was not present in the entry level master groups when asked the question of why critical thinking is important in clinical education. Undergraduate students replied “yes in order to be able to determine injuries and solve problems the rehab process” and another student answered

“yes, athletic trainers have to solve various problems everyday and must find solution in an appropriate manner”.

Research Question Two Findings: 3. What has influenced your critical thinking ability in clinical education?

Similar to the last two questions themes emerged that were both common between the two groups but others were unique. Both the entry level master and undergraduate group identified *prior experience* as being integral to influencing their ability to critically think in clinical education. Prior experience was the most common response for entry level master students. Responses ranged from “drawing on my experience prior to graduate school” to “my education as well as personal experiences out in the real world have taught me the necessary skills to critically think in not only clinical education as well as my daily life”. Forty-five percent of entry level master students perceived their life experiences as having the most influence on their ability to critically think. It was clear that entry level master students acknowledged their life experiences as having much more influence as compared to the undergraduate sample. Thirteen percent of undergraduate students responded with “prior experience” as being an influencer compared to 45% of entry level master students. The theme of experience is comparable between the two groups when analyzing their responses. Both groups refer to “prior experience” or “experience outside of school” as being influential.

Another similarity between the groups is the theme of *current educational program*. However the percentage of influence reported was much different. Only

10% of entry level master response mentioned their current educational program as compared to 24% of undergraduate students. In addition the analysis of the undergraduate sample revealed two sub themes unique to the group. Of the students that discussed the impact of their current educational experience 6% of the undergraduates specifically mentioned their current clinical assignment. Where as the remaining students in that theme subdivided into the influences of *current classroom experience*. More undergraduate students perceived what influenced their ability to critically think to be their didactic portion of education as compared to the clinical aspect. This is much different from the entry level master sample in which no one indicated their current classroom experience improved their ability to critically think.

Another theme that emerged and is reflected in both groups was the students' acknowledgement of their *preceptors* as a major influence in critical thinking. The percentage of students from both samples that indicated preceptors as influencing was similar. The entry level master sample revealed 31% of respondents as compared to undergraduate at 36%. After analysis both groups revealed a subtheme of *being challenged*, 14% of masters' students, 9% of undergraduates. The last theme to emerge from this question was *observation* and was only found in the undergraduate group. Nine percent of the undergraduate sample identified *observing* as influencing their ability to critically think. For example "seeing multiple injures that appear to be the same, but they all are a little different and must be approached and treated individually" or observing health care professionals. I've learned how to apply my clinical

thinking skills from the health care professionals". These responses both have a clinical medicine aspect and students' critical thinking processes are centered on providing good health care. See appendix D for all number and percentages of responses within themes.

Summary

This chapter presented the data analysis process and the statistical comparisons between entry level master and undergraduate athletic training students in both critical thinking skill as well as the students' perceptions of critical thinking. The purpose of this study was to determine if a difference exists between entry level master and undergraduate athletic training students in critical thinking skill. Utilizing the CCTST-2000, scores were recorded for overall critical thinking skill and subscales of induction, deduction, analysis, inference and evaluation. Analysis of the six scores between the two academic levels revealed no significant differences between the groups. Overall critical thinking skill scores and subscale scores did not significantly differ between entry level master and undergraduate athletic training students.

The key findings of their perceptions were provided through the analysis of open ended question responses. Through this analysis themes and subthemes emerged. The findings were addressed in the order the questions were asked and compared the two sample populations. The themes correspond and address the second research question. Each of the research questions will be discussed in Chapter 5.

CHAPTER 5

DISCUSSION

This chapter's purpose is to provide a discussion of the findings from the study. In this section the research questions were restated and data analysis summarized to provide the following findings.

Research Question One Summary

“What is the difference between current students graduating from an entry-level master’s athletic training education program and students graduating from an undergraduate athletic training education program, in critical thinking skills”. It was determined that no statistical significant difference was found between entry level master and undergraduate athletic training students. It was determined there was no difference in critical thinking skill score nor any of the subscale scores between undergraduate and entry level master students. In addition it was apparent through correlational analysis that age, gender, and ethnicity had no relationship to the athletic training students critical thinking skill score.

For comparisons to published literature it was necessary for scores on the CCTST-2000 to be converted from the 100-pt. version to the 34-pt. version. Prior to 2012 the CCTST-2000 scores were presented in a 34 point scale with one point representing each question. Insight Assessment felt it was necessary to take the existing test and convert the results to a 100 point scale. The conversion table is provided in table 16.

Table 16

Critical Thinking Skill Score Conversions

34-Point Scale	100-Point Scale	Interpretations
0	52.40	Overall skill in critical thinking not manifested. Results also consistent with possible insufficient test-taker effort, cognitive fatigue, or possible reading comprehension issues.
1	53.80	
2	55.20	
3	56.60	
4	58.00	
5	59.40	
6	60.80	
7	62.20	
8	63.60	Weak overall skill in critical thinking predictive of difficulties with educational and employment related demands for reflective problem solving and reflective decision making.
9	65.00	
10	66.40	
11	67.80	
12	69.20	
13	70.60	Moderate overall skill in critical thinking indicating potential for skills related challenges when engaged in the reflective problem-solving and reflective decision making associated with learning or employee development.
14	72.00	
15	73.40	
16	74.80	
17	76.20	
18	77.60	
19	79.00	Strong overall critical thinking skill, consistent with the potential for academic success and career development.
20	80.40	
21	81.80	
22	83.20	
23	84.60	
24	86.00	
25	87.40	Overall critical thinking skill that is superior to the vast majority of undergraduate and graduate test takers. Skills at the superior level are consistent with the potential for more advanced learning and leadership
26	88.80	
27	90.20	
28	91.60	
29	93.00	
30	94.40	
31	95.80	
32	97.20	
33	98.60	
34	100.00	

Note. $n=29$

The scores for the two groups of athletic training students are displayed in table 17. As mentioned in chapter 2 the field of nursing education has done the most extensive assessment of critical thinking skill in medical education. Other

studies measuring differences between academic levels produced mixed results. Entry level master athletic training students mean total score was consistent with senior level nursing students. Facione and Facione (1997) revealed senior nursing students scored a mean of 16.40 as compared to entry level master students at 16.66. Undergraduate athletic training students in this study also were similar to critical thinking skill score as their means score was 14.81 as compared to nursing students in table 3.

Table 17

Converted Critical Thinking Overall & Subscale Scores

	Entry Level Masters	Undergraduate
Scale	Mean	
Total Score	16.66	14.81
Induction	19.03	17.90
Deduction	16.97	14.95
Analysis	18.41	15.87
Inference	18.55	16.84
Evaluation	14.52	14.81
	<i>Note. n=29</i>	<i>n=53</i>

Results of this study are consistent with Facione (1997) and Chau et al., (2001) indicating no relationship between gender and critical thinking skill score in nurses. The results of this study indicate male and female athletic training students enrolled in both undergraduate and entry level master programs share similar abilities in critical thinking skill. As a result, it is suggested it would not be necessary to differentiate critical thinking skill instruction based on gender.

The lack of significant difference between the two groups of students is not consistent with the work of Facione (1997) whom measured a difference in critical thinking between different ages of nursing students. The lack of significant

difference found in this study may be due to a difference of only two years of formal schooling between the two groups or due to the potential response bias in participation. The participants who chose to take the test may be quite different in critical thinking skills than those who chose not to take the test. Those who choosing to take the test average age difference was slightly higher at 24.51 years for entry level master students compared to 21.79 for undergraduate. The 2.72 year difference in age between the two groups of students denotes a small time for maturation. The results of this study are also in conflict with Colucciello (1997) who demonstrated a difference in critical thinking skill scores at different levels of nursing education. However, Colucciello did measure nursing students whom were both formally admitted to the nursing curriculum and those that were not formally admitted. Where as this study measured critical thinking between two different levels of athletic training education but all participants were formally admitted into the academic program.

The results also are in conflict with the work of McCarthy, Schuster, Zehr & McDougal, 1999, and Profetto-McGrath, 2003, whom both found statistically significant differences in critical thinking skill score among different points of education. Both of these studies were longitudinal in nature as compared to present study where the sample population was only tested once.

The average critical thinking skill score and subsequent sub scale scores all are categorized as moderate as defined by Insight Assessment (2012). Moderate overall skill in critical thinking indicates a potential of the tester to hold skill when engaged in the reflective problem solving and decisions making

environment (Insight Assessment, 2012). This is consistent with the work of Becke et al, 2001, and Velde, 2006. Both researchers found similar critical thinking skill scores as compared to the present study and attributed, in part to the lack of motivation by the testers. Health care related fields can find non-field specific tests as non-motivating (Becke et al, 2001; Velde, 2006). This could have been a contributing factor to the moderate scores values.

Both groups of athletic training students scored the highest in subscale scores of induction and inference. Inference skills are utilized when one suggests hypothesis or draws conclusions (Facione, 2012). Inductive reasoning as defined by Facione (2012) is reasoning in contexts of uncertainty. Therefore, according to this sample of athletic training students are strongest in hypothesis generation and making decision in contexts of ambiguity. These results are in conflict with Collucciello (1997) in which senior level nursing students scored the highest in deductive reasoning versus inductive reasoning. Results indicate a higher level of reasoning in precisely defined contexts where decision making is bound by precise policies and procedures (Facione, 2012). Both studies are in conflict with Beckie, Lowery and Barnett (2001) which found inductive reasoning and inference skills to be in the middle of critical thinking skills. This is comparable to Bartlett and Cox (2002) who found inductive reasoning and inference skills to be in the middle of all critical thinking skills in physical therapy students.

Compared to other areas of health care education athletic training students were similar. This sample of students demonstrated a lower score as compared to physical therapy students. Bartlet & Cox (2002) demonstrated a mean critical

thinking skill score at 20.03 however; they only tested twenty-six students.

Pharmacy students were slightly higher as measured by McCall et al. (2007) at 18.15. McCall, unlike Bartlet & Cox, measured 373 students. This study revealed a higher critical thinking skill score compared to Dental Hygiene students (Williams et al., 2001).

Research Question Two Summary

“What are the components of athletic training clinical education that an athletic training student recognizes or perceives as helpful in increasing their critical thinking skill in both undergraduate and graduate level students?” To answer this question, participants answered three open ended questions. *“What does critical thinking mean to you”* was asked to underpin student’s perception of what they perceived as influencing their ability to critically think. As noted in the field of critical thinking it is necessary when analyzing critical thinking skill to work from a consistent definition. It was apparent through both the entry level masters as well as undergraduate athletic training students they defined critical thinking in a variety of ways. In both groups, decision making, problem solving, and analyzing data were consistent themes. Undergraduate student’s expanded on those themes and added application of information and thinking on ones feet for an immediacy of thought followed by quick action.

Lacking in all students’ definitions of critical thinking was the process of reflection that was advocated by Mezirow (1989), and Brookfield (1995). The students were partially aligned with Pauls (1993) conceptualization of critical thinking in which he lists analyzing data as a central tenant however, does not

mention problem solving or decision making. Both groups of students in this study are more similar to the work of Duchscher (1999) where she explored the definition of critical thinking specific to the health related field in which she lists problem solving, and decision making as key components. However, Duchscher also included reflection which was absent from the students responses in this study. The definitions provided and subsequent themes developed in this study were in partial congruency with Ennis (1985) who advocated for decisions making but only after reflection.

Students' definitions of critical thinking are partially congruent with the 1990 American Psychological Association (APA) Delphi definition utilized to underpin research question one. However, the concern is the definition is so robust that it is easy to find some similarities. Analysis, evaluation and judgment were found in both the students' definitions as well as the APA definition. The APA consensus report goes on to mention critical thinking is purposeful and a self-regulating phenomenon. Participants' answers did not include references to purposeful thinking or refer to self regulation.

The question as to whether students felt critical thinking was important to athletic trainers in clinical education was answered yes by all participants. Both groups added that the importance of critical thinking lies in the ability to make decisions and provide good health care. This comes in the form of applying a skill and-or making a good diagnosis. These attributes are more associated with clinical decision making and not critical thinking as defined by this study.

The last question addressing research question two was asking the students to identify what has influenced their ability to critically think in clinical education. Groups were consistent in identifying prior experience, and preceptors. Undergraduates, in addition identified observing where as entry level master students identified applying what they have learned. The difference between the groups in this study was the large percentage of entry level master students identifying prior experience as the key determinant to influencing their critical thinking ability, where as the undergraduate groups revealed a larger percentage of students indicating their educational experience as being the key influencer. The variance in themes between the two groups indicates master students perceive their critically thinking ability is mostly influenced from experiences outside of formal education in comparison to undergraduate students who relied on their preceptors. Both groups identified a strong theme of preceptors as influencing their ability to critically think, however, the entry level master students had a larger percentage of students specifically mentioning the preceptors challenging them. The finding of being challenged by instructors or preceptors is consistent with the recommendations of Browne and Freeman (2000), Heinrichs (2003), and Walker (2003). Brown and Freeman (2000) specifically advocate for the importance of challenging students and creating some conflict in order for the student to develop critical thinking skills.

Interpretation of Results

This study examined critical thinking skill scores between entry level master and undergraduate athletic training students. Findings indicated there was no difference in critical thinking skill total score or any of the sub scale scores. These findings suggest critical thinking was not a result of level of athletic training education. Based on these findings, you could assume that entry level master students do not have a higher level of critical thinking skill compared to undergraduate athletic training students. Both entry level master and undergraduate athletic training students scored similar to CCTST aggregated norm sample scores of nursing and was similar to other medical related fields.

The analysis of demographic variables impacting critical thinking skill also revealed no correlation. These results are consistent with prior research and indicate no need to address critical thinking skill differently based on gender, age or ethnicity for athletic training education students.

In the researchers opinion Allied Health and nursing have embraced the importance of critical thinking. However, as indicated by this study simply agreeing that critical thinking is important to the field has not resulted in agreement as to what critical thinking is. Several cognitive activities were mentioned by participants as being integral. Problem solving, decision making, analyzing, and judgments were mentioned. However, participants did not identify assumptions, biases, or methods of logical reasoning.

Both groups of students identified their preceptors as having a strong influence on their ability to critically think. This signifies the importance in

preceptors being able to not only be good critical thinkers themselves but to be good instructors of critical thinking. Entry level master students found prior experience as being the most influential ingredient to their ability to critically think denoting the importance of prior experience and its potential impact on recruiting and selecting students into the professional phase of athletic training education.

Limitations of the Study

The following are limiting factors to this study.

1. The results of this study are limited to the participants and are not generalizable to all entry level master and undergraduate athletic training students.
2. The test atmosphere was not controlled for. Students were allowed to take the on-line exam and chose a time and location that was convenient. Time and location differences may have influenced testing results.
3. A corresponding Carnegie Classifications match was not available for all institutions.
4. Not all invited programs had participants. Program directors at participating schools may have encouraged students to perform well while others might not have given any encouragement.
5. Students chose whether or not to participate. This may have led to a self selection bias.

Conclusions

This study assessed critical thinking skill in both undergraduate as well as entry level master athletic training students. However, only 82 out of 174 students invited for participation completed the assessment. The sample may not have been large enough groups to accurately reflect the total population. Future studies should consider increasing the sample size to include all institutions representing all possible Carnegie classifications. Sample bias may have influenced the results as students whom were enrolled at an athletic training education program in which the program director chose not to respond to researches solicitation, were not given an opportunity to participate. In addition the time required to take the test may have influenced who chose to participate. The cost of the CCTST instrument is a factor in broadening the measurement of critical thinking skills. In addition the results of this study are based on data provided in a single-cross-sectional process. Data collected over time in a longitudinal manner may yield a more accurate depiction of athletic training critical thinking skill, allowing for a more detailed examination between the two groups of students. The CCTST was used extensively in nursing education with the majority of studies examining program entry and exits. This pre and post-testing model was initiated to measure an outcome standard of critical thinking that is found in nursing accreditation standards. This should be considered if athletic training education standards adopt critical thinking as an outcome standard as well.

Due to comparable critical thinking skill scores within the field of allied health and nursing the focus of critical thinking in athletic training could turn to the development of skill. The examination into the development of critical thinking skill in both populations may be more fruitful. Recommendations for future studies in the areas of critical thinking in athletic training education should focus on the development of critical thinking. Instructional strategies should be incorporated in the curriculum to include both classroom as well as clinical learning environments. Pre and post testing would be necessary to measure a change in critical thinking over time. Knight (2008) referenced the need to purposefully teach critical thinking skills to athletic training students. Walker (2003) identified mechanisms to promote critical thinking in athletic training education, such as questioning, discussing, debating and written assignments.

In future research exploring the effectiveness of teaching methods on the development of critical thinking is paramount to establish a consistent definition of critical thinking. As mentioned in chapter two most research in the scope of critical thinking is inconclusive at measuring the effectiveness of critical thinking instruction. This may require the creation of a more athletic training specific conceptualization of critical thinking.

The definition utilized in this study comes from the APA definition and is not discipline specific. The lack of a consistent definition of critical thinking has been problematic. The definition of critical thinking provided by the APA provides consistency however, lacks the specific nature of allied health or athletic training. Future studies in the field of athletic training education may benefit from a

discipline specific definition of critical thinking. It may be prudent to explore how faculty teaching in athletic training education programs relates decision making, problem solving and analyzing data to critical thinking.

Athletic Training educators must understand the role preceptors have in the formation of critical thinking in students. This study clearly reveals the impact preceptors have on student's ability to critically think. Future mentoring or education should be provided to the preceptors' who most often are not formally employed by the school that sponsors the athletic training education program. These preceptors need to be instructed on how to implement critical thinking initiatives when working with and instructing athletic training students.

Implications for future research

The definitions and understanding of critical thinking found in this study was broad and not specific to health care. An area of concern regarding future research in the field of critical thinking in athletic training education is to conceptualize a definition of critical thinking that is more specific to the profession. The CCTST is well supported in the literature and good instrument to measure general critical thinking skills. However, as indicated by the short answer responses when attempting to determine what influences students ability to critically think, it is difficult to accurately evaluate. Student's conception of what critical thinking was had such a large variance. When assessing critical thinking skill specific to a profession a more discipline specific definition is needed. Interviews in which a definition of critical thinking could be discussed between the researcher and participant may be a more effective mechanism to unify the

construct of critical thinking. A more fruitful conversation could take place in which subjects could provide a more valid and reliable answer as to what influences their ability to critically think.

Many of the studies in the field of critical thinking were longitudinal designs that measured both pre and post entry critical thinking skill. It would be beneficial to the field to determine if undergraduate or entry level master students increased their critical thinking skill while enrolled in the program. Exploring the possible growth or development of critical thinking skills between the two groups would be beneficial. In addition, it would be helpful to explore the potential difference in critical thinking skill between these two groups of students at different intervals post certification.

An investigation into the critical thinking skill level of preceptors would help provide some clarity as to the current state of critical thinking in preceptors. Athletic Training students clearly found their preceptor as having significant influences on their critical thinking skill development. No research has been done evaluating preceptors current level of critical thinking skill or their understanding of how to teach critical thinking.

Recommendations

Research designs in which non-response bias is diminished is recommended. Incentives to possible participants may help include the choice of those selected to participate. In addition direct solicitation of athletic training students may prove to increase participants as opposed to soliciting program directors. As indicated in chapter 4 critical thinking skills were not statistically

different between entry level master and undergraduate athletic training students that were in their final year of education. Thus, this study suggests it would be recommended not utilizing critical thinking skill as a mechanism to differentiate the two routes to certification. However, in light of the limitations, further research is needed. As the field of athletic training education explores the possibility of transitioning to a singular educational route to certification athletic training program directors should take caution in utilization of critical thinking skills as part of the conversation. The literature is clear as to the importance of not only for health care providers but more broadly all citizens to engage in and increase their utilization of critical thought. However as this study indicates there is no difference between these two groups.

With the emphasis that allied health and higher education has placed on critical thinking it continues to be vital for athletic training education programs. Athletic training education research should focus on the development of critical thinking skill versus a snapshot measurement as this study provides. The exploration into the process of critical thinking development within existing programs is needed. This exploration may provide valuable insight as to what techniques or environments influence critical thinking. Athletic training students from around the country are exposed to a variety of clinical educational environments that are not uniform from school to school. Each educational institution has a variety of preceptors who may use different methods to develop critical thinking to students. This study revealed students perceptions of what influenced their critical thinking ability but empirical analysis may further identify

what those factors are. It is imperative we focus on clinical education experiences as this provides the most diversity in experience as opposed to the didactic component. Accreditation standards have homogenized the process of athletic training education. Pre and post testing of critical thinking skills from time of entry to exit of athletic training education programs and cross reference results to different clinical experiences should occur.

The qualitative portion suggests the importance athletic training student preceptors play in influencing their critical thinking skill. Both groups of students identified their preceptors as being important. Further investigation would be needed to determine as to what extent this influence is occurring. The exploration into measuring critical thinking skill of preceptors is recommended. No research has been done in athletic training education to explore teaching qualities of preceptors. Most preceptors are chosen out of convenience and a simple willingness to provide this support to local athletic training education programs. Critical thought is important in allied health and students perceive their preceptors as having the most influence in this development. Therefore it will be imperative to examine preceptors' critical thinking ability and then determine if a correlation exists between students and preceptors critical thinking ability.

Lastly, the dominant paradigm of critical thinking research in allied health has been quantitative. Thus the majority of literature driving the study was deductive. In order to achieve a deeper and richer understanding of the experience in which critical thinking may or may not occur and the factors that may influence critical thought, a qualitative paradigm is needed. Specifically, I

recommend identifying characteristics of teaching skills as they relate to critical thinking and how do preceptors then teach critical thinking. To gain this insight and achieve richness in perspective a qualitative approach is prudent.

Final Summary

Critical thinking has been identified as being an essential skill for health care providers as well as students graduating from higher education. As a result, it has become an expectation of health care professions to ensure that students possess these skills. Critical thinking has not been well studied in athletic training education. A growing debate within the field of athletic training is emerging as to the elimination of the undergraduate route to certification. This study serves as a starting point to differentiate the value between these two educational routes as they relate to critical thinking. The challenges surrounding the topic of critical thinking is first defining it and then subsequently developing a metric to measure it. The APA Delphi study with its subsequent CCTST provided the best option for this study as it was the most widely accepted and utilized test. However, as indicated by the results of the qualitative response participants held a difference in how they conceptualized it.

Critical thinking skill scores were not significantly different between the two groups' studies and all were similar when compared to students in nursing and allied health. Experience both prior to formal schooling and clinical education is paramount in shaping and forming student's perceived ability to critically think. Specifically the importance preceptors have in questioning and challenging

students. It is important to select and educate preceptors on the importance of critically thinking and their impact on students.

Formal testing, pre and post entry, into athletic training education similar to many studies in nursing may yield significant information. As athletic training education programs evolve it will be necessary to add critical thinking as outcome standards. However, as this study indicates in relation to critical thinking it did not reveal a difference if students were formally educated at an undergraduate level or entry level master level.

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APPENDIX A.1
**LETTER OF SOLICITATION
ENTRY-LEVEL MASTERS**

Date

Program Directors Name
Address
University
City, State Zip Code

Hello my name is Mike Wendinger and I'm currently working on a doctoral dissertation entitled "Critical Thinking in Athletic Training Education". I am attempting to determine if a difference exists between current students graduating from an entry-level master and students graduating from an undergraduate athletic training education program, in critical thinking skills. Therefore, I'm requesting your assistance in soliciting athletic training students that are within the last year of their graduate athletic training education.

Critical Thinking has been extensively studied in medical, nursing and other allied health related fields; however a significant deficiency exists in athletic training education. In addition the debate within the profession as to the elimination of the undergraduate route and mandate the masters as the only route to certification. Presently there is no research exploring critical thinking in comparing these two groups in athletic training education. Therefore, this study may provide some insight as to the level of critical thinking skill in these two populations.

I am asking for your cooperation in gathering critical thinking skill scores of your graduate students. If you are willing to help in soliciting your students' participation I would need them to take a on-line critical thinking skills test that is timed lasting 45 minutes. The test can be offered at your convenience however I request all tests to be completed by the end of September 2012.

Your student's identity along with their results will remain confidential and no identifier will be linked to the individual student. You would be given a baseline critical thinking skill score for your students at no cost. In addition I would be happy to send the results of the study to you if you desire.

I am soliciting the participation of all 26 entry level master programs listed on CAATE's website and the first 10 to respond will be included in my study. Thank you for considering my request. If your school chooses to participate please contact me as soon as possible with the appropriate number of students willing to take the critical thinking inventory. I will then send you the needed information for you to administer the on-line examination along with the consent forms to sign by all willing participants'. If you have any questions regarding this study please call me at: 218-726-8637

Sincerely,

Michael Wendinger, MA, ATC, CSCS

APPENDIX A.2
**LETTER OF SOLICITATION
BACHELORS**

Date

Program Directors Name
Address
University
City, State Zip Code

Hello my name is Mike Wendinger and I'm currently working on a doctoral dissertation entitled "Critical Thinking in Athletic Training Education". I am attempting to determine if a difference exists between current students graduating from an entry-level master and students graduating from an undergraduate athletic training education program, in critical thinking skills. Therefore, I'm requesting your assistance in soliciting athletic training students that are within the last year (Senior Year) of their undergraduate athletic training education.

Critical Thinking has been extensively studied in medical, nursing and other allied health related fields; however a significant deficiency exists in athletic training education. In addition the debate within the profession as to the elimination of the undergraduate route and mandate master degrees as the only route to certification. Presently there is no research exploring critical thinking in comparing these two groups in athletic training education. Therefore, this study may provide some insight as to the level of critical thinking skill in these two populations.

I am asking for your cooperation in gathering critical thinking skill scores of your undergraduate students. If you are willing to help in soliciting your students' participation I would need them to take an on-line critical thinking skills test that is timed lasting 45 minutes. The test can be offered at your convenience however I request all tests to be completed by the end of September 2012.

Your student's identity along with their results will remain confidential and no identifier will be linked to the individual student. You would be given a baseline critical thinking skill score for your students at no cost. In addition I would be happy to send the results of the study to you if you desire.

I have solicited all 26 entry level master programs listed on CAATE's website and have 10 programs willing to participate. After reviewing these 10 programs your institution was purposely selected for solicitation as it reflects many of the same characteristics. Thank you for considering my request. If your school chooses to participate please contact me as soon as possible with the appropriate number of students willing to take the critical thinking inventory. I will then send you the needed information for you to administer the on-line examination along with the consent forms to sign by all willing participants'. If you have any questions regarding this study please call me at: 218-726-8637

Sincerely,
Michael Wendinger, MA, ATC, CSCS

APPENDIX B.1

CONSENT FORM

Critical Thinking in Athletic Training Education: Measurement of skill Entry-Level Masters Athletic Training Students

You are invited to be in a research study exploring critical thinking in athletic training education as it relates to bachelors in comparison to entry level master students. You were selected as a possible participant because you are a student enrolled in a CAATE Accredited entry-level master's athletic training education program. I ask that you read this form and ask any questions you may have before agreeing to be in the study.

This study is being conducted by: Michael J. Wendinger, University of Minnesota Duluth, Doctor of Education candidate.

Background Information

The purpose of the study will be to add to the debate as to whether athletic training students should be formally trained at the graduate or undergraduate level based on their critical thinking skill. It is essential to determine if a relationship exists between athletic training student's current level of education and their measured ability to critically think.

Specific Questions that should be answered

- RQ1. What is the difference between current students graduating from an entry-level master's athletic training education program and students graduating from an undergraduate athletic training education program, in critical thinking skills?
- RQ2. What are the components of athletic training clinical education that an athletic training student recognizes or perceives as helpful in increasing their critical thinking skill in both undergraduate and graduate level students?

Procedures:

If you agree to be in this study, I would ask you to do the following:

- Complete an on-line 34 multiple choice test that is limited to 45 minutes
- Answer four open-ended questions as part of the on-line exam

Risks and Benefits of being in the Study

There is minimal to know risk in participating in this study. Minimal risks include feeling uncomfortable answering potentially difficult questions of an electronic version of the California Critical Thinking Skills Test.

There is no direct or immediate benefit for you in participating in this study.

Compensation:

This study does not include any direct or indirect compensation. You will receive your scores immediately upon completion of the exam.

Confidentiality:

The records of this study will be kept private. In any sort of report I might publish, your identity will not be revealed in the results and your responses to all questions will remain confidential. Group comparisons will be made and reported. You will have an opportunity to create a password that will allow only you to access your identifying information. At no time will the offering of your name be needed.

Voluntary Nature of the Study:

Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with the University of Minnesota or your current school of enrollment. If you decide to participate, you are free to not answer any question or withdraw at any time with out affecting those relationships.

Contacts and Questions:

The researcher conducting this study is: Michael Wendinger. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact him at University of Minnesota Duluth, 1216 Ordean Court, SpHC 25 Duluth MN 55812, (218) 726-8637, mwending@d.umn.edu.

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher(s), **you are encouraged** to contact the Research Subjects' Advocate Line, D528 Mayo, 420 Delaware St. Southeast, Minneapolis, Minnesota 55455; (612) 625-1650.

You will be given a copy of this information to keep for your records.

Statement of Consent:

I have read the above information. I have asked questions and have received answers. I consent to participate in the study.

Signature: _____ Date: _____

Signature of Investigator: _____ Date: _____

APPENDIX B.2

CONSENT FORM

Critical Thinking in Athletic Training Education: Measurement of skill Bachelor Level Athletic Training Students

You are invited to be in a research study exploring critical thinking in athletic training education as it relates to bachelors in comparison to entry level master students. You were selected as a possible participant because you are a student enrolled in a CAATE Accredited bachelor level athletic training education program. I ask that you read this form and ask any questions you may have before agreeing to be in the study.

This study is being conducted by: Michael J. Wendinger, University of Minnesota Duluth, Doctor of Education candidate.

Background Information

The purpose of the study will be to add to the debate as to whether athletic training students should be formally trained at the graduate or undergraduate level based on their critical thinking skill. It is essential to determine if a relationship exists between athletic training student's current level of education and their measured ability to critically think.

Specific Questions that should be answered

- RQ1. What is the difference between current students graduating from an entry-level master's athletic training education program and students graduating from an undergraduate athletic training education program, in critical thinking skills?
- RQ2. What are the components of athletic training clinical education that an athletic training student recognizes or perceives as helpful in increasing their critical thinking skill in both undergraduate and graduate level students?

Procedures:

If you agree to be in this study, I would ask you to do the following:

- Complete an on-line 34 multiple choice test that is limited to 45 minutes
- Answer four open-ended questions as part of the on-line exam

Risks and Benefits of being in the Study

There is minimal to know risk in participating in this study. Minimal risks include feeling uncomfortable answering potentially difficult questions of an electronic version of the California Critical Thinking Skills Test.

There is no direct or immediate benefit for you in participating in this study.

Compensation:

This study does not include any direct or indirect compensation. You will receive your scores immediately upon completion of the exam.

Confidentiality:

The records of this study will be kept private. In any sort of report I might publish, your identity will not be revealed in the results and your responses to all questions will remain confidential. Group comparisons will be made and reported. You will have an opportunity to create a password that will allow only you to access your identifying information. At no time will the offering of your name be needed.

Voluntary Nature of the Study:

Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with the University of Minnesota or your current school of enrollment. If you decide to participate, you are free to not answer any question or withdraw at any time with out affecting those relationships.

Contacts and Questions:

The researcher conducting this study is: Michael Wendinger. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact him at University of Minnesota Duluth, 1216 Ordean Court, SpHC 25 Duluth MN 55812, (218) 726-8637, mwending@d.umn.edu.

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher(s), **you are encouraged** to contact the Research Subjects' Advocate Line, D528 Mayo, 420 Delaware St. Southeast, Minneapolis, Minnesota 55455; (612) 625-1650.

You will be given a copy of this information to keep for your records.

Statement of Consent:

I have read the above information. I have asked questions and have received answers. I consent to participate in the study.

Signature: _____ Date: _____

Signature of Investigator: _____ Date: _____

APPENDIX C

TEST-TAKER INSTRUCTIONS FOR ON-LINE CCTST

Test consists of 34 multiple choice questions and is timed to 45 minutes.

1. Open your browser and navigate to home page:

www.insightassessment.com

2. Click the Yellow “Test-taker Logic” Button at the top right of the home page.

3. When the dark blue Login screen appears enter the Login and Password you have been given for your test assignment:

Example: Login: XYZuniv2012 Password: Graduate12

Note: If you have any problems with the logic, you can check the configuration of your computer by using the “click here” diagnostic on the Login screen.

4. To ensure you do not lose your responses, please review the navigational aids on the “Warning” screen and then click “Continue.”

5. Give the system a moment to load Java. You will see a Java logo and progress bar on a white screen.

Note: Please follow any instructions that may appear asking to “open” or “run” the Java program.

6. When your personal profile page opens: Respond to all the items on this screen and then click “Save Profile”. You can click “Continue” to move to the test itself only after your profile is saved.

7. Select the CCTST-2000 using the pull down menu then click “Continue”.

8. Accept the User Agreement Terms.

9. Read the test instructions and continue take the exam.

10. Depending on the screen resolution of your computer, you may need to use the scroll bar to read the questions and answer choice.

11. After completing all the questions, submit your response by clicking “Done”

12. You can see the time remaining in the timer displayed on the top right of your screen. Your responses will be submitted for scoring automatically if time expires.

13. Once you’ve completed the test you may Log Out, or view and print your results.

APPENDIX D.1

Entry Level Master Responses

1. What does Critical Thinking mean to you?

Theme	#	%
Analyzing Data	7	24%
Problem Solving	6	21%
Decision Making	6	21%
Processing information	3	10%
Thinking	3	10%
Evaluate	3	10%

2. Is Critical Thinking Important for Athletic Trainers in Clinical Education, Why?

Theme	#	%
Decision Making	10	34%
Acknowledge CT occurs outside books	8	28%
Providing good health care	10	35%
a. make good diagnosis	(6, 21%)	
b. application of skill	(4, 14%)	

3. What has influenced your ability to Critical Thinking in Clinical Education?

Theme	#	%
Prior Experiences	13	45%
Preceptors	9	31%
a. being challenged	(4, 14%)	
Applying / Practicing skill	3	10%
Current Educational Program	3	10%

APPENDIX D.2

Undergraduate Responses

1. What does Critical Thinking mean to you?

Theme	#	%
Analyzing Data	6	11%
Reasonable/"Rationale Thinking	4	7%
Thinking "outside the box"	9	17%
Problem Solving	8	15%
Decision Making	6	11%
Application of info/skill	7	13%
Thinking	11	21%
a. Thinking on feet/quickly (7, 13%)		

2. Is Critical Thinking Important for Athletic Trainers in Clinical Education, Why?

Theme	#	%
Adaptation	17	32%
a. adapt quickly (4, 8%)		
Decision Making	8	15%
Providing good health care	11	21%
a. think of all possibilities (3, 6%)		
Problem Solving	16	30%

3. What has influenced your ability to Critical Thinking in Clinical Education?

Theme	#	%
Prior Experiences	7	13%
Current Educational Program	13	24%
a. current clinical experience (5, 6%)		
b. current classes (8, 15%)		
Observing	5	9%
Preceptors	19	36%
a. being challenged (5, 9%)		
Problem Solving	2	4%