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## **Optimizing Workforce Performance: Perceived Differences of Army Officer Critical Thinking Talent Across Level of Education**

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OPTIMIZING WORKFORCE PERFORMANCE: PERCEIVED DIFFERENCES  
OF ARMY OFFICER CRITICAL THINKING TALENT  
ACROSS LEVEL OF EDUCATION

by

Richard Benedict Ayers

A Dissertation  
Submitted to the Graduate School  
at The University of Southern Mississippi  
in Partial Fulfillment of the Requirements  
for the Degree of Doctor of Philosophy

May 2016

## ABSTRACT

# OPTIMIZING WORKFORCE PERFORMANCE: PERCEIVED DIFFERENCES OF ARMY OFFICER CRITICAL THINKING TALENT ACROSS LEVEL OF EDUCATION

by Richard Benedict Ayers

May 2016

The U.S. Army's operating environment continues to become increasingly complex and unpredictable, where U.S. technological advantage continues to erode. The complexities stem from the Army's doctrinal assumption that the future operating environment is unknown and constantly changing (Department of the Army [DA], 2014a). Diminishing technological advantage results in more reliance on soldiers' cognitive capability and less on high technology weapons systems (McMaster, 2015).

A review of military literature shows extensive research on the importance of Army leaders to be talented critical thinkers (Fischer, Spiker, & Riedel, 2008, 2009; Gerras, 2008; Thomas & Gentzler, 2013). Human capital literature reveals that many college graduates do not possess the critical thinking skills required of the workforce (Laird, Seifert, Pascarella, Mayhew, & Blaich, 2014; Liu, Frankel & Roohr, 2014). Senior Army leaders identify critical thinking and problem solving as the most important outcomes of officer education, but they also maintain graduates of Army education institutions often lack these competencies (Hatfield, Steele, Riley, Keller-Glaze, & Fallesen, 2011).

Human capital theory (Becker, 1993) and human resource development theory (Swanson, 2001) form the theoretical framework of this study to measure the perceived

level of critical thinking talent of junior Army officers with different levels of education, and determine if differences exist between groups. The two groups in the sample consist of junior Army officers with ( $n = 50$ ) and without ( $n = 50$ ) a 4-year college degree. Both groups were administered the CCTDI and CCTST critical thinking instruments, and one-way MANOVAs calculated the effect of a 4-year degree on perceived level of critical thinking talent. No significant effect was indicated between groups on either CCTDI scores or CCTST scores.

This non-experimental, cross-sectional, explanatory study finds that 4-year degrees may not produce the critical thinking outcomes the Army expects. The Army can mitigate this through developing a critical thinking framework across the professional military education continuum as well as evaluating leader critical thinking talent during Army training events. Future considerations include larger samples across multiple Army installations and multiple branches.

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## DEDICATION

The long arduous journey of a dissertation requires tremendous support and patience not of the budding scholar, for it is they who volunteered and brought the work onto themselves. No, the support and patience come from those who find themselves on the journey as well. It is to these family members that this work is dedicated. To my brother who ventures through his own academic journey and should be finished very soon as well, I thank you for always understanding for all the times I had to cut our conversations short for the sake of this work. To my parents, who instilled in me at an early age the confidence to achieve lofty goals. To my second Mom Sigrid, for your unending encouragement and support, danke meiner lieben Mutti für alles sehr, Ich liebe dich! To my beautiful children who endured so many of my hours away from them, I thank you for your patient understanding about “some paper” that seems to take an awfully long time to write. Finally, to my beautiful wife, whose love, patience, and support have given me the strength to put the work in each day. My copy editor, proof-reader, and motivator, with a keen sense of knowing when it was time for me to step away from the research and writing, you have had to manage so many things on your own, I cannot thank you enough. I continue to be amazed at your strength, and what you are able to accomplish. I love you, and without you, I could not have done it.

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### Disclaimer

The opinions expressed herein reflect the personal views of the author and not those of the United States Army or the United States Department of Defense.



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## LIST OF ABBREVIATIONS

<i>BOLC</i>	Basic Officer Leaders Course
<i>CCTDI</i>	California Critical Thinking Disposition Inventory
<i>CCTST</i>	California Critical Thinking Skills Test
<i>DA</i>	Department of the Army
<i>MANOVA</i>	Multivariate Analysis of Variance
<i>WOBC</i>	Warrant Officer Basic Course

## CHAPTER I

### INTRODUCTION

The U.S. Department of the Army describes its future operating environment as highly complex, ambiguous, and full of uncertainty (Department of the Army [DA], 2014a). The complexities from the Army's future operating environment stem from the assumptions that the future is unknowable and constantly changing (DA, 2014a), and much of war's uncertainty stems from its human element (McMaster, 2015). Policymakers in the United States (U.S.), like senior Army leaders, are unable to predict when and where the adversaries of the U.S. will pose a threat to national security. Regardless of where a threat to U.S. national interest emerges across the globe, it is likely the Army will play a key role in the threat response. Army leaders are not politicians, but know war is an extension of politics and winning war is a political outcome (Davidson, 2010). This relationship between war and politics is not new for the Nation enters its wars with a desired end state that is favorable to regional or strategic interest (Schadlow, 2005). The Army must organize, equip, and train its workforce to create the conditions for sustainable political outcomes. The U.S. must often engage in war and other military operations to achieve national policy outcomes consistent with the Nation's vital interests. The Prussian military theorist Clausewitz wrote of this relationship in his 1832 work, *On war* (Clausewitz, Howard, & Paret, 1976), and professional military education students continue to study this work. The study of history develops military leaders in their ability to ask the right questions, but it is the understanding of the particular political implications of localized conflict that develops the answers (McMaster, 2015). Soldiers in future conflict must be prepared for a broad menu of mission sets against state and

non-state actors. This is a paradigm shift from what Army leaders faced in the past, and preparing for an unknown and complex operating environment will continue to challenge the ability of future Army leaders to develop ready organizations. Necessary to appreciating the complexity of the Army's future operating environment is a historical understanding of how the Army previously prepared its workforce to meet the needs of the Nation.

### Background

An example of what Army leaders faced in the previous operating environment occurred during the period of post-World War 2 to the early 1990s. This timeline frames the Cold War era, the period when the primary threat to U.S. national interest was the Soviet Union. Although beyond the scope of this research to describe Soviet policies during the Cold War Era, U.S. policymakers of the time showed deep concern for the Soviet nuclear threat as well as the threat of Soviet expansionism into Western Europe (Berle, 2015). The Soviet Union, along with its Warsaw Pact allies, continually prepared to confront Western forces on the plains of Western Europe, and remained a global threat (Fischer, 1997). The U.S. Army knew this familiar threat quite well. The U.S. Army during the Cold War period was educated in Soviet weapon systems' capabilities and limitations, Soviet doctrine and strategy, troop strengths, and what languages they spoke (Mellenthin, Stolfi, & Sobik, 1984). During this era, U.S. soldiers would go to the field to participate in training exercises designed to defeat the primary threat to U.S. national interests, the Soviet army (Mellenthin et al., 1984). The end of the Cold War marked the beginning of a complicated foreign policy transition period for the United States. As an example, in 1993, U.S. president Bill Clinton remarked jokingly, "Gosh, I miss the Cold

War,” speaking to the stark divergence of the Cold War’s well-known enemy to the ambiguous situations he faced in the Balkans, Haiti, and Somalia (Devroy & Smith, 1993).

In contrast to the Cold War period, 21st century soldiers do not know what region of the globe they will go to next, nor do they necessarily know what they will do when they get there (Davidson, 2010). Army leaders will continue to find themselves engaged in situations that look dissimilar to those they have previously experienced and studied (Fischer et al., 2009). An ambiguous enemy contributes to the complexity of the Army’s future operating environment.

#### *Future Operating Environment*

The Soldiers on the future battlefield will progressively find themselves involved in diverse mission sets against persistent, adaptive, and difficult to identify enemies. Insurgents, terrorists, and other non-conventional, non-state actors continue to oppose the national interests of the United States (DA, 2014a), and the Army must be prepared to defeat them. The numerous failures in governance across the Middle East have propagated violent extremism and have set the stage for persistent conflict (Cordesman & Khazai, 2014). Violence continues to propagate from Africa and central and southeast Asia, and with it are persistent threats against U.S. national interests (U.S. Department of State, 2014).

The Nation asks a great deal from its Army, and the Nation turns to the Army frequently to shape political outcomes (Davidson, 2010). Army leaders know one of their primary missions is to provide the Nation’s policymakers with strategic options. These options manifest as varying degrees of military operations, from defense support to



civil authorities and stability operations, to offensive and defensive combat operations (DA, 2011). Success in complex military operations requires Army leaders' understanding of complex problems before attempting to solve them, and Army leaders should possess the cognitive abilities to constantly adapt to, and assess, ever-changing situations (Cojocar, 2011). Some of the Nation's most complex challenges originate with the number of actors unconstrained by the moral and legal convictions of traditional military forces who continue to use violence to achieve their goals (Wardynski, Lyle, & Colarusso, 2009). Future Army leaders will require high levels of cognitive readiness, and they must be prepared to react to a diverse menu of potential global crises with intuitive decision-making (Fautua & Schatz, 2012). Decision-making and problem solving are cognitive processes that require a broad ability to think (Minda, 2015; Tümakaya, Aybek, & Aldağ, 2009). To understand the Army strategy to optimize cognitive performance through workforce development and performance improvement initiatives, a foundational understanding of human capital development concepts and theories is critical.

### *Theoretical Foundations of Human Capital Development*

Army doctrine identifies the soldier as the key to gaining competitive advantage in the future, as opposed to high technology weapons (DA, 2014a; McMaster, 2015). Understanding the strategic goal of the Army to optimize human performance through its Human Dimension Concept (DA, 2014b) requires knowledge of the theoretical foundations of workforce development and performance improvement. Education enhances cognitive capabilities (Ritchie, Bates, & Deary, 2015), and the most important investment in human capital is education (Becker, 1962, 1993). Human capital theory

asserts workforce productivity improves through investment in human capital (Becker, 1993). A foundational element of the Army strategy to develop its human capital is to raise the level of cognitive performance across the profession (DA, 2014b). Becker (1993) specifies, “investment in education and training are the most important human capital investments” (p. 17).

Building upon human capital theory (Becker, 1962, 1993), human resource development theory (Swanson, 2001) purports human resource development (HRD) is a practice of creating and using expert knowledge for improving workforce performance. Swanson (2001) asserts two major realms of practice support this theory. The first is organizational development; the second is training and development (Swanson, 2001). These two primary components of HRD focus on human expertise, which aligns closely with the Army’s goal of optimizing human performance (DA, 2014b). Within the two elements of HRD, training and development *develops* human expertise, and organization development *unleashes* human expertise (Swanson & Holton, 2009). Swanson and Holton (2009) assert that “assessment of HRD successes or results can be categorized into the broad domains of learning and performance.” (p. 4) Learning and performance are essential elements of the leader development process (DA, 2013). Since complex problem solving and decision-making are indispensable traits for Army leaders, it is necessary to examine one of the foundational cognitive processes of those traits, critical thinking (Fisher, 2011; Kallet, 2014).

Definitions of critical thinking are numerous in the literature (Ennis, 1993; Facione, 1990; Halpern, 2001c; Paul & Elder, 2006). In its broadest definition, critical thinking is the cognitive, regulated, purposeful process of judgment about what to believe

or do (Giancarlo & Facione, 2001). This study follows the definition of critical thinking developed by Facione in the American Philosophical Association Delphi Report on Critical Thinking (Facione, 1990).

### *Methods of Developing Critical Thinking*

Education literature is rich with research indicating one of the most important outcomes of higher education is critical thinking (Abrami et al., 2008; Behar-Hohenstein & Niu, 2011; Duron, Limbach, & Waugh, 2006; Facione, 1990; Halpern, 1999; Liu, Frankel & Roohr, 2014; Nusche, 2008; Paul & Elder, 2001; Pellegrino & Hilton, 2012; Tiruneh, Verburgh, & Elen, 2014). An important distinction in understanding critical thinking as a construct is that critical thinking is not analogous to cognitive ability or intelligence (Butler, 2012) for they are at best modestly related (Stanovich & West, 2008). Indeed, a critical thinker is not necessarily smart or clever but is one who engages in purposeful, reflective thought, and does so intentionally.

In the context of this research, critical thinking talent refers to both critical thinking disposition and critical thinking skill collectively, and this research determines the relationship between higher education and level of critical thinking talent. Critical thinking relates to the cognitive skills of self-regulation, interpretation, analysis, evaluation, inference, and evaluation (Facione, 2015). Although critical thinking talent is an important goal within the military, critical thinking definitions are fragmented (Fischer et al., 2009). Cognitive psychology forms the theoretical foundation for critical thinking theory; however, critical thinking is an interdisciplinary field spanning philosophy, economics, mathematics, and education (Halpern, 2001c). Varying definitions of critical thinking exist in the literature, yet commonality exists across their foundational

principles, and critical thinking emerges as an important skill across numerous disciplines and fields of study (Fischer et al., 2009). One of the Army's warfighting challenges is to develop agile and adaptive leaders capable of operating in uncertain environments. If the Army is to create agile and adaptive leaders, the Army must know the competencies agile and adaptive leaders must possess. The next section describes the competencies the Army identifies as critical for successful workforce performance.

The Army identifies critical thinking and problem solving as essential leader competencies (Allen & Gerras, 2009; DA, 2011, 2013; Fischer et al., 2008, 2009), and education literature defines critical thinking as one of the most important outcomes of higher education (Dietz & Schroeder, 2012; Tiruneh et al., 2014). Halpern (2003) asserts higher education could increase level of critical thinking talent. Research indicates college students often increase their critical thinking skill while in school; however, missing are specific factors contributing to this increase (Renaud & Murray, 2007). What is less evident in the literature is the level of critical thinking talent of college graduates relative to the level in non-college graduates in a similar work setting. To address this gap in the literature, the current study examines two groups of junior Army officers with different levels of education. Higher education institutions recognize the need to develop the critical thinking skills expected of the workforce, but colleges have demonstrated inconsistent success in producing graduates who are critical thinkers (Flores, Matkin, Burbach, Quinn, & Harding, 2012). Not all college graduates are as equally equipped to emerge from their higher education experience ready to engage in higher-level thought (Laird, Seifert, Pascarella, Mayhew, & Blaich, 2014). If higher education does not develop the cognitive processing skills required by Army leaders to observe problems

from varying perspectives with conflicting information, and still be able to make sound decisions, then the resulting gap will produce poor leaders (Flores et al., 2012). The Army currently lacks any foundational understanding of the level of critical thinking talent across its workforce, as well as measures that determine whether higher education develops critical thinking talent in its leaders. The concept of sending hundreds of thousands of Army personnel to civilian higher education institutions is not economically prudent. If the Army requires its leaders to possess critical thinking talent normally developed through higher education, then the Army could address gaps in critical thinking through its own professional military education institutions.

#### *Army Professional Military Education*

If the Army goal is to optimize cognitive performance, the Army's internal education systems should prepare to enhance critical thinking in its leaders through education (Straus et al., 2014). The Department of Defense (2015) defines education across its services within the cognitive and affective domains of learning and utilizes Bloom's (1956) Taxonomy of Learning Domains as a useful hierarchy for possible levels of learning. Through this hierarchal perspective, the Chairman of the Joint Chiefs of Staff Instruction 1800.01E (2015) describes that the value of officer education is to "foster breadth of view, diverse perspectives, critical analysis, abstract reasoning, comfort with ambiguity and uncertainty, and innovative thinking, particularly with respect to complex, non-linear problems" (p. A-1).

At key points during their careers, Army leaders develop their intellectual capital through progressive and sequential educational opportunities that help enhance their knowledge of war (DA, 2014d). To achieve desired critical thinking learning outcomes,

the Army needs a measure of the level of critical thinking talent across its workforce. If the Army desires its leaders to be talented critical thinkers, Army education institutions should be prepared to analyze the critical thinking construct to include examining the traits of successful critical thinkers. The measurement of critical thinking disposition and skill is important to identify strengths and weaknesses in students' cognitive capabilities (Facione, 2015). Much of the critical thinking literature discusses critical thinking in terms of higher-level thought, thinking about thinking, rational judgement, and concepts which educators can teach (Ennis, 1962; Facione, 2015; Halpern, 2003). The Army can facilitate cognitive behavioral changes most effectively in a classroom environment (Abrami et al., 2008). Since the Army seeks a behavioral change in its workforce through improved critical thinking, the Army could develop educational strategies to improve critical thinking talent across the Army learning continuum. An evidence-based measure of junior Army officer perceived level of critical thinking talent among college-educated and non-college educated soldiers can establish a framework for critical thinking curriculum design (McCarthy, Schuster, Zehr, & McDougal, 1999).

#### Statement of the Problem

Future armed-conflict will become increasingly complex due to a highly capable and elusive enemy (DA, 2014a). Future military budget reduction exacerbates the complexity of the future operating environment (Congressional Budget Office, 2011). The Army must prepare to face the Nation's adversaries with a reduced workforce size coupled with a reduced budget, which creates substantial readiness challenges for the Army that result in more reliance on soldiers' cognitive capability and less on high technology weapons systems (McMaster, 2015). The ability to execute mission

command, make sound decisions, and solve complex, ill-defined problems in a chaotic operating environment requires Army leaders to possess critical thinking talent (DA, 2011, 2012a). The Army specifies critical thinking as one of the most essential leader competencies, (DA, 2013; Gerras, 2008; Fischer et al., 2009; Schumm, Webb, Turek, Jones, & Ballard, 2010; Thomas & Gentzler, 2013). Nevertheless, broad assessment of Army leader critical thinking talent remains challenging.

One of the expected outcomes of higher education is producing graduates who are critical thinkers (Carmel & Yeziarski, 2013; Denial, 2012). Senior Army leaders identify critical thinking and problem solving as the most important outcomes of officer education, but literature reveals that graduates of Army education institutions often lack critical thinking and problem solving skills (Hatfield et al., 2011). If higher education is indeed the principal method by which one develops critical thinking talent, this may present the Army with an educational challenge. Since 78% of the Army's workforce does not possess a college degree (Department of Defense [DoD], 2013), then the Army may need to develop strategies to address gaps in critical thinking through its own professional military education institutions. The level of soldier education across the Army varies extensively (DoD, 2013), and the Army currently does not assess the critical thinking talent of its leaders at any point along the leader development continuum. If the Army collects empirical data regarding the level of critical thinking talent of its leaders, the Army may then be able to design and implement leader development strategies which foster the improvement of cognitive skills, skills which the literature reveals can be developed through education (Facione, 2015; Halpern, 1998; Halpern & Nummedal, 1995). Without a framework to optimize cognitive performance through leader

development processes, the Army could unnecessarily delay its efforts to optimize human performance in the cognitive domain. This delay may introduce risk for the Army in achieving the level of cognitive readiness necessary for success in the future operating environment.

### Purpose of the Study

The purpose of this study is to measure the perceived levels of critical thinking disposition and skill of two groups of junior Army officers with different levels of education, and determine if differences exist between groups. The Army identifies critical thinking talent as an essential leader competency (DA, 2013; Fischer et al., 2008, 2009; Williams, 2013), yet currently uses no evidence-based measure as a framework to develop critical thinking talent. Therefore, this study determines if perceived critical thinking differences exist between junior officers with a college degree and junior officers without a college degree. This data can inform future critical thinking education strategies for the Army.

### Research Objectives

The objectives of this study focused on the assessment of critical thinking talent of junior Army officers. The primary research question is what are the levels of critical thinking disposition and skill of junior Army officers across level of education? Additionally, in support of the primary research question, this study addresses the following research objectives (RO):

RO1: Describe the demographic characteristics of the sample in terms of level of education, age, and years of service.



RO2: Determine junior Army officers' perceived level of critical thinking disposition as measured by seven attributes that influence an individual's capacity to learn and apply critical thinking skills.

RO3: Determine junior Army officers' perceived level of critical thinking skills as measured by seven core-reasoning skills needed for reflective decision-making.

RO4: Determine differences in perceived critical thinking disposition across participant level of education.

RO5: Determine differences in perceived critical thinking skill across participant level of education.

RO6: Examine the within-group relationship between CCTDI scores and subscale scores with CCTST scores and subscale scores.

### Conceptual Framework

The conceptual framework for this study illustrates the Army's goal to optimize human performance in order to gain a competitive advantage; the goal's relationship to the theoretical foundations supporting Army human capital development; the identification of critical thinking as an essential Army leader competency, and the gap in knowledge of the level of Army critical thinking talent. The conceptual framework also depicts higher education as a foundational means to develop critical thinking (Denial, 2012) and varying education levels for the Army members. The conceptual framework further illustrates the intent of this study to measure critical thinking disposition and critical thinking skill of two groups of junior Army leaders with different levels of education. This study measures perceived levels of critical thinking talent across level of education and determines if differences exist between groups.

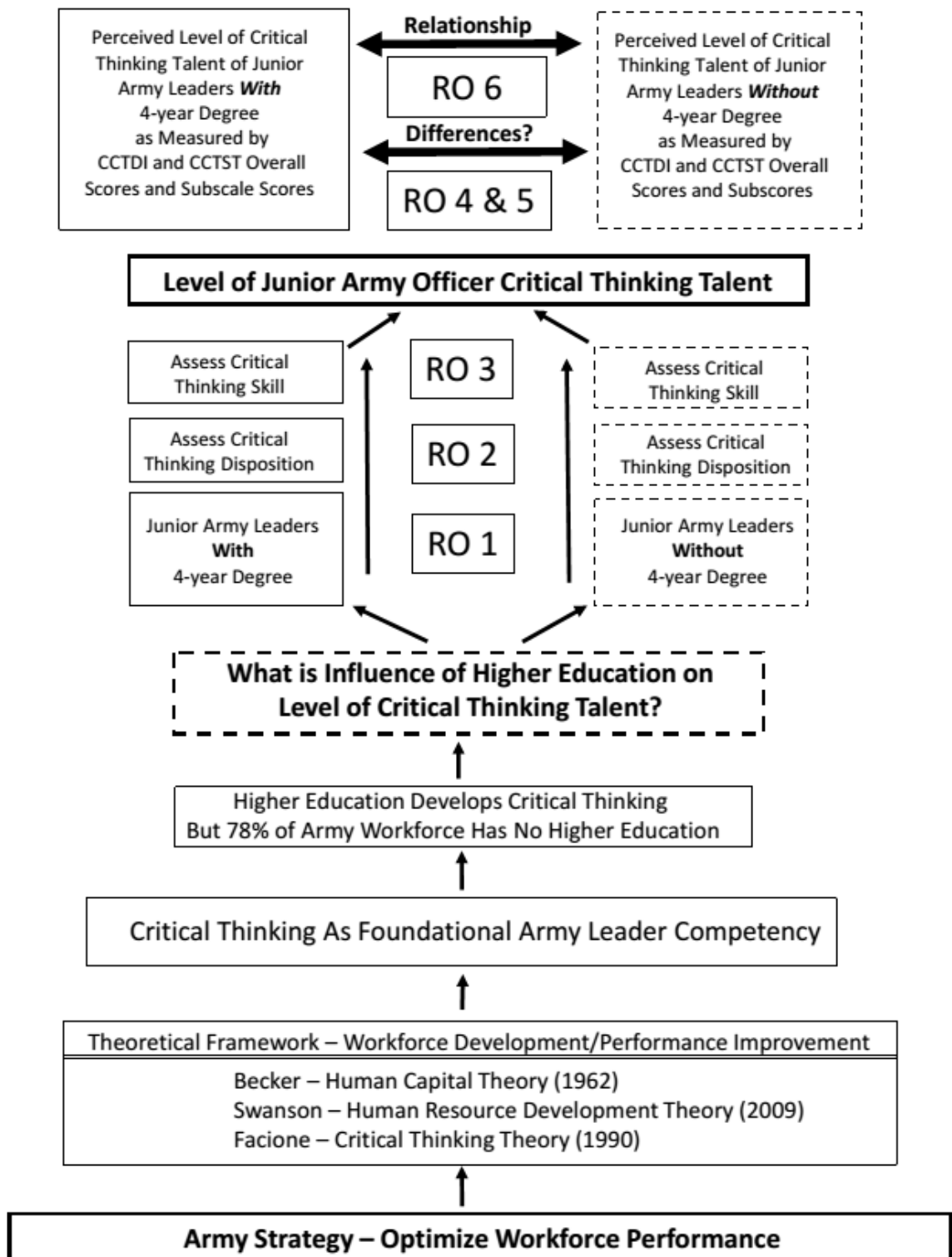


Figure 1. Conceptual Framework.

### Significance of the Study

The number of studies examining critical thinking disposition and skill of Army officers is limited. This research measures junior Army officer critical thinking disposition and critical thinking skill, and determines if differences exist between junior Army officers with a 4-year degree and junior officers without a 4-year degree. This study provides important insights regarding junior Army officer level of critical thinking talent. Data collected from this study informs future critical thinking curriculum development and classroom instructional techniques, which can support the Army in its goal to achieve cognitive advantage. Human capital theory describes the investment in education as the most important investment to increase individual or workforce productivity (Becker, 1993). A foundational understanding of the levels of critical thinking talent of Army leaders can inform critical thinking curriculum development for soldiers with varying levels of college education. Investing in critical thinking education can facilitate optimized cognitive performance (Facione, 2015; Halpern, 2001a) which can support the Army's goal to retain cognitive advantage over the Nation's adversaries.

### Limitations

The purpose of discussing study limitations is to address potential gaps in the study's design, instrumentation, researcher bias, and study population (Creswell, 2003). Limitations of the study include the population of the study (junior Army officers), study scope, and data availability. This study determines perceived level of critical thinking talent of a small group ( $n = 100$ ) of junior Army officers, which limits the generalizability to other populations. This study has the potential to increase educational development of

critical thinking talent by providing a foundational framework of the level of critical thinking talent of the Army's workforce.

### Delimitations

This study measures the perceived level of critical thinking talent of two groups of junior Army officers with different levels of education, and determines if differences exist between groups. Due to the numerous definitions of critical thinking across psychological, philosophical, and educational literature, this study recognizes the construct of critical thinking as defined by the American Philosophical Association Delphi Report on critical thinking (Facione, 1990), and thus utilizes two instruments designed from the Delphi consensus definition of critical thinking (Facione, 1990). Other delimitations of this study include the theoretical framework that critical thinking talent is measurable, and improves through education (Ennis, 1985; Halpern, 1998). This study limits the population of interest to junior Army officers at a large military post in the southeast.

### Definition of Key Terms

The following definitions are relevant to the study. Terms relating to the instruments used in this study are extracted directly from Insight Assessment (2015), the owner of the two instruments. Due to the numerous definitions in the literature for critical thinking, this study utilizes the definitions related to the critical thinking construct as defined below:

1. *Critical thinking* – “Purposeful, self-regulatory judgment, which results in interpretation, analysis, evaluation, and inference, as well as explanation of the

evidential, methodological, criteriological, or conceptual considerations upon which that judgment is based” (Facione, 1990, table 1, p. 3).

2. *Critical thinking disposition* – “Consistent internal motivations to act toward, or respond to persons, events, or circumstances in habitual, yet potentially malleable ways” (Facione, 2000, p. 6).

3. *High-order Thinking Skills* – Cognitive processes relating to the top three levels of Bloom’s six levels of intellectual behavior; analysis, synthesis, and evaluation. Although continued research has produced literature that has reordered the top two levels (Anderson & Krathwohl, 2001), their hierarchy is not significant for this definition.

4. *Human Capital* – Investments in education and training are investments in human capital, as one cannot separate them from the knowledge and skills they impart on the individual (Becker, 1993).

5. *Reasoning skill* – The ability to use reasoned judgment to consider evidence and concepts, and to use interpretation, analysis, inference, evaluation, explanation, and self-regulation in decision-making (Facione, 1990).

6. *Army Lieutenant* – The members of one of the two sub-groups in this study are Lieutenants. Lieutenants are company-grade officers. The rank of Lieutenant is the entry-level rank for the majority of commissioned officers in the Army and lead small units consisting of 16-44 soldiers (DA, 2015c).

7. *Army Warrant Officer* – The members of one of the two sub-groups in this study are Warrant Officers. Warrant Officers are technically focused officers who

perform the primary duties of systems integrator, technical leader, and advisor (DA, 2015c).

The following definitions relate specifically to the California Critical Thinking Disposition Inventory. The seven subscales on the inventory describe the overall disposition one has toward using critical thinking in the formation of judgments about what to do or believe, and are defined below explicitly as outlined in the instrument (Insight Assessment, 2015a):

8. *Truthseeking* – “The habit of always desiring the best possible understanding of any given situation; it is following reasons and evidence where ever they may lead, even if they lead one to question cherished beliefs” (Insight Assessment, 2015a, para. 2).

9. *Open-mindedness* – “The tendency to allow others to voice views with which one may not agree. Open-minded people act with tolerance toward the opinions of others, knowing that often we all hold beliefs that make sense only from our own perspectives” (Insight Assessment, 2015a, para. 3).

10. *Analyticity* – “The tendency to be alert to what happens next. This is the habit of striving to anticipate both the good and the bad potential consequences or outcomes of situations, choices, proposals, and plans” (Insight Assessment, 2015a, para. 4).

11. *Systematicity* – “The tendency or habit of striving to approach problems in a disciplined, orderly, and systematic way” (Insight Assessment, 2015a, para. 5).

12. *Confidence in reasoning* – “The habitual tendency to trust reflective thinking to solve problems and to make decisions” (Insight Assessment, 2015a, para. 6).

13. *Inquisitiveness* – “Intellectual curiosity. It is the tendency to want to know things, even if they are not immediately or obviously useful. It is being curious and eager to acquire new knowledge and to learn the explanations for things even when the applications of that new learning are not immediately apparent” (Insight Assessment, 2015a, para. 7).

14. *Maturity of judgment* – “The habit of seeing the complexity of issues and yet striving to make timely decisions. “A person with maturity of judgment understands that multiple solutions may be acceptable while yet appreciating the need to reach closure at times even in the absence of complete knowledge” (Insight Assessment, 2015a, para 8).

The following definitions relate specifically to the California Critical Thinking Skills Test. The seven subscales on the inventory describe the overall strength one has toward using critical thinking in the formation of judgments about what to do or believe, and are defined below explicitly as outlined in the instrument (Insight Assessment, 2015b):

15. *Analysis* – How people identify arguments, clarify meaning, and interpret significance.

16. *Evaluation* – how one assesses arguments and their credibility, as well as stating opinions and justifying methods.

17. *Inference* – refers to the ability to question evidence and draw conclusions.

18. *Deduction* – is “the assumed truth of the premises purportedly necessitates the truth of conclusion” (Insight Assessment, 2015b, para. 6). Conclusions are certain if the premise is true.

19. *Induction* – means “an argument’s conclusion is purportedly warranted, but not necessitated by the assumed truth of its premises” (Insight Assessment, 2015b, para 7).

20. *Interpretation* – “skills used to determine the precise meaning and significance of a message or signal, whether it is a gesture, sign, set of data, written or spoken words, diagram, icon, or a chart or graph” (Insight Assessment, 2015b, para. 9).

21. *Explanation* – “Explanatory reasoning skills, when exercised prior to making a final decision about what to believe or what to do” explaining further that “strong explanatory skills enable people to discover, to test and to articulate the reasons for beliefs, events, actions and decisions” (Insight Assessment, 2015b, para. 10).

### Summary

The complexity of the Army’s future operating environment requires its leaders to possess high-level cognitive skills as talented critical thinkers and problem solvers (Allen & Gerras, 2009; DA, 2011; Fischer et al., 2009). Reductions in the size of the Army’s workforce coupled with budget constraints create substantial challenges for the Army that will result in more reliance on soldiers’ cognitive capability and less on high technology weapons systems (McMaster, 2015).

This chapter discussed the Army strategy to optimize cognitive performance through its Human Dimension Concept (DA, 2014b), and the role of critical thinking as an essential workforce competency. Robust research in education literature shows one of the most important outcomes of college education is critical thinking talent (Abrami et



al., 2008; Behar-Hohenstein & Niu, 2011; Duron et al., 2006; Facione, 1990; Halpern, 1999; Liu et al., 2014; Nusche, 2008; Paul & Elder, 2001; Pellegrino & Hilton, 2012; Tiruneh et al., 2014). However, most members of the Army workforce are not college graduates. The Army does not know if differences in critical thinking talent exist across levels of education. Understanding the level of critical thinking talent relative to level of education may optimize the creation of knowledge in the professional military education classroom, enhance higher-order thinking skills, improve reasoning and decision-making, and develop leaders who are better critical thinkers. These outcomes could then allow the Army to gain competitive advantage by optimizing cognitive human performance.

## CHAPTER II

### REVIEW OF RELEVANT LITERATURE

This purpose of this study was to measure the perceived levels of critical thinking talent of two groups of junior Army officers with different levels of education, and determined if differences exist between the two groups. This chapter provides a review of the relevant literature supporting the conceptual framework of the study. The review of literature includes an overview of workforce development and performance improvement, the critical thinking construct applied to the current study, and methods the Army could use to develop critical thinking as an essential leader competency.

The Chairman of the Joint Chiefs of Staff, General Martin Dempsey, stated that throughout his forty-plus years of active military service, the world has never been more unstable and unpredictable (Garmone, 2015). The Army's future operating environment will be ambiguous, complex, and chaotic (DA, 2014a). Army leaders will find themselves in some of the most stressful, disordered, and dangerous environments imaginable, where killing and the prospect of death are frequently present (McMaster, 2015). The instinctive ability of military leaders to develop morally sound, yet operationally prudent decisions through habit of mind is essential in such an operating environment. In order for Army education institutions to be prepared to develop critical thinking talent, the Army needs greater insight into the processes surrounding critical thinking development (Tsui, 2008).

Critical thinking literature describes improvement in critical thinking as a process which is slow in development (Halpern, 1998), and the average individual struggles to think critically (Lai, 2011). Critical thinking in higher education is a contentious topic

regarding its definition, ability to assess, and practical application (Liu et al., 2014). The literature addresses critical thinking as one of the fundamental outcomes of higher education (Abrami et al., 2008; Behar-Hohenstein & Niu, 2011; Duron et al., 2006; Facione, 1990; Halpern, 1999; Liu et al., 2014; Nusche, 2008; Paul & Elder, 2001; Pellegrino & Hilton, 2012; Tiruneh et al., 2014). The Army develops leaders through the processes of training, education, and experience (DA, 2013). Army leader development processes can improve soldiers' cognitive abilities through developing critical thinking disposition and critical thinking skill (DA, 2014b). However, the Army has no data on the current level of soldiers' critical thinking talent. Considerable data is available regarding higher education as a means to develop critical thinking, but research on alternative methods of developing critical thinking talent is sparse. Additionally, the Army has scarce data regarding the level of critical thinking talent between leaders with varying levels of education.

To examine these gaps in knowledge, this chapter will discuss the theoretical framework of workforce development and performance improvement, and how, through developing human capital, the Army can achieve competitive advantage through optimized human performance. This chapter discusses critical thinking literature relevant to optimizing human performance, as well as prominent critical thinking theorists and their viewpoints on methods for developing critical thinking talent.

If the Army is to provide the Nation with multiple options to deliver sustainable national security outcomes, then the Army should have a robust capacity to win decisively across a diverse set of mission requirements. This capacity to win requires Army leaders to be operationally adaptive, and critical thinking forms the foundation of

this adaptability (DA, 2012b). In order to accomplish future missions successfully, the Army must train and educate soldiers now, and do so well beyond levels of previous generations of soldiers. Army leaders need to be physically, cognitively, and socially prepared to win across a diverse mission set (DA, 2014b). The complexity from the future operating environment stems from the principle assumption that the future is unknown and constantly changing. However, within this complex environment the Army must engage determined, elusive, and increasingly capable enemies (DA, 2014a). Current training and education initiatives set the stage for future battlefield success, and optimizing cognitive performance provides the Army with the foundational capability to meet a broader set of missions in the future.

Army leaders are not politicians, but they know war is an extension of politics, and winning war is a political outcome (Davidson, 2010). The United States engages in war and other military operations to achieve national policy goals. In the past two decades, the Army participated in numerous operations around the world that did not involve conventional large-scale warfare, and the Army expects this trend to continue (DA, 2014a). This situation places tremendous stress on Army leaders as it is challenging to develop training and education strategies for a force that does not know where it is going and what it will do when it arrives (Davidson, 2010). It is the mission of the Army to provide options to the Joint Force and to present multiple dilemmas to the Nation's adversaries (DA, 2014a).

In the future, potential adversaries of the United States will include non-state actors, violent extremist organizations, and non-uniformed militia groups. These adversaries continue to undermine security across regions, most notably in North Africa

and Middle East (JCS, 2015). These potential adversaries are aware of the capabilities of the U. S. military and its highly trained and well-equipped joint force. Much of the Nation's military advantage in the 21st century lies within high-technology weapons systems. The Army cannot prepare for the future operating environment through an overreliance on technology (McMaster, 2015). The enemies of the United States will avoid large, conventional, force-on-force engagements, and will plan to engage the U.S. using asymmetric, unconventional methods to defeat U.S. technological advantage (McMaster, 2015). These methods include insurgent behavior, cyber-attacks, global positioning system signal disruption, terror tactics, and other internet-based propaganda and recruiting. Such techniques are difficult to counter, which creates challenges for military leaders in their development of concise military solutions to complex problems. The ability to distinguish between threats will continue to diminish in the future, due to the number of actors involved, the rapid adaptability of threats, and the complexities that surround adversaries (DA, 2012).

Stability operations is not a new mission set for the Army, but there is a mindset within the Army that stability and reconstruction operations are not the core missions of what the Army is supposed to do, but something the Army does in between major ground wars (Davidson, 2010). Army leaders recognize the Nation will continue to ask the Army to provide options for complex national security and foreign policy challenges. Army leaders acknowledge that civilians in the government are not always going to have the answers to complex political challenges, and it is up to the Army to describe its capacity and provide the civilian leadership with options (Davidson, 2010). Often military solutions to crises include operations other than war. Beyond engaging in land

warfare, Army doctrine prescribes preventing conflict as one option available to national policymakers, as is shaping the security environment (DA, 2012b). Achieving national security interests without war is the most desirable outcome (McMaster, 2015).

Preventing conflict and shaping the security environment, like direct ground combat, are missions requiring Army leaders to possess good judgement as well as the logic and reasoning skills essential to critical thinkers (Allen & Gerras, 2009).

A recent example of how the Army provides the Nation's policymakers with options for preventing conflict is the 2014-2015 humanitarian relief mission in West Africa, where the U.S. Army provided forces in support of Ebola relief in the most adversely affected countries of Guinea, Liberia, and Sierra Leone. In October 2014, Western Africa was suffering from over 50 new cases of Ebola per day (Centers for Disease Control and Prevention [CDC], 2015). The CDC (2015) cites statistics, which estimated that for each 30-day delay in providing isolative treatment for Ebola patients, the number of new daily cases could triple. Between March 2014 and April 2015, an ongoing outbreak of Ebola affected an estimated 25,000 people, with over 10,000 deaths (CDC, 2015). This type of destabilizing health crisis has broad negative effect. A lack of intervention could potentially lead to a complete societal breakdown of the regions affected. Had the U.S. Ebola crisis intervention not been instituted and transmission risks not been mitigated, the CDC estimated that somewhere between 500,000 to one million cases of Ebola would currently be active in Western Africa. It is very likely that the affected governments would begin to lose control of their respective countries, and their socio-economic structures might collapse. Historical analysis of the past 30 years shows this region of Africa would likely see warlords and other non-state actors exploit the gap

created by the failure of legitimate government, which would destabilize the region even further (Davidson, 2010). As one of the many agencies called upon to intervene, the U.S. Army deployed to Western Africa for Ebola relief efforts, and began operations upon arrival. The Army provided stability and security, as well as medical intervention and expertise, and averted a pandemic. This is one example of how the Army prevents conflict on behalf of the Nation. Had these measures not taken place, the Army may have likely had to intervene later in a much different role, arguably one more militaristic in nature. One only has to look to the U.S. military responses to the crises during the 1990s in Somalia, Haiti, Bosnia-Herzegovina, and Kosovo to understand the level of complexity and uncertainty in operations other than war (Davidson, 2010). Humanitarian relief and peacekeeping missions can quickly transition to conflict, as was the case in Somalia in 1993. These are examples of the level of complexity Army leaders will continue to face in the future, examples that form the need for critically thinking leaders.

The Army's future operating environment will not be linear. A lack of defined linear boundaries on the future battlefield, such as a front line or a rear operations area, exacerbates complexity. Ambiguity can challenge sound decision-making, as Army leaders in ambiguous conditions must sift through personal bias, time constraints, and rushes to judgement in unclear circumstances. It is indeed the primary trait of an ill-defined problem to lack a distinct solution (Williams, 2013). Although challenging, Army leaders must operate within the ambiguity and complexity that characterize the full-spectrum operating environment, fully aware that imperfect information and limited situation awareness characterize their environment. Even while immersed in chaos, the Army requires its leaders to execute the art of command and the science of control in

order to seize, retain, and exploit the initiative to achieve desired outcomes (DA, 2012a). As strategic uncertainty grows, so must the cognitive demands of the Army soldier (DA, 2012c; McMaster, 2015). To develop competencies such as sound decision-making, reasoned judgment, and reflective thought, the Army can examine critical thinking and its relationship to chaotic military environments.

An important perspective in the practical application of the tenets of critical thinking is from Paparone (2014), who criticizes a purely intellectual viewpoint as the *logico-scientific* approach to critical thinking. As a faculty member at the U.S. Army War College, Paparone (2014) noted that students' observations and experiences in chaotic operating environments are unique, and require interpretation. Interpreting one's observation and experience conflicts with the purely objective, scientific Paul and Elder (2014) model of critical thinking (Paparone, 2014). Making meaning of what is happening in an uncertain environment is essential to sound decision-making, and critical thought is essential to interpreting meaning (Paparone, 2014). Army professionals must have the cognitive skills necessary to question thinking and notions that dissociate war from its political nature and assure winning through high technology systems (McMaster, 2015). Previous conflict found Army leaders with too little information available. In the future, Army leaders will find themselves overwhelmed with information, which creates new challenges for sound decision-making. As a method for gaining competitive advantage over the Nation's' adversaries, the Army is developing strategies to optimize human performance. This study will examine the cognitive element of human performance optimization by measuring the critical thinking disposition and skill of junior Army officers relative to their level of college education.



## Theoretical Framework

This study measured the critical thinking talent of two groups of junior Army officers, and determined if differences in levels of critical thinking talent exist between the two groups. The study drew upon human capital theory (Becker, 1962, 1993) to describe the Army's strategy to optimize cognitive performance through investment in the workforce. Human capital theory purports that one of the single most important investments made in human capital is investment in education (Becker, 1993). This study followed the framework of Becker's (1993) economics-focused point of view in that the Army invests in leader education on the assumption that it will receive a return on investment in subsequent periods.

Optimizing human performance for making full use of expertise is a central tenet of human resource development theory (Swanson, 2008). In the scope of workforce development and performance improvement, human resource development theory is analogous to the Army strategy to optimize human performance. Swanson (2008) purports that overall performance improvement, from the individual to the organization, relies upon the training and development of individuals. An ideal relationship exists between developing soldiering skill and intellectual skill (Petraeus, 2007). Increasing the level of intellectual capital of the Army through training and education will require a focus on the subject of critical thinking. The definition of critical thinking developed by Facione (1990) with a panel of critical thinking theorists and experts through the Delphi method frames the critical thinking construct of this study.

### *Human Capital Theory*

U.S. economist Gary Becker developed his theory of human capital through researching the estimated return to collegiate and high school education in the United States (Becker, 1962). The Army makes significant human and fiscal capital investment in executing its leader development strategy (Zaccaro et al., 2015). The Army model for leader development through education rests in students' attending resident courses of instruction, based primarily on promotion to positions of higher rank and responsibility. When the Army selects leaders for promotion, these leaders expect to attend the requisite course of professional military education to prepare them for the requirements and responsibilities of their new rank. Examining Army leaders as a homogeneous workforce, this study utilized Becker's (1993) framework that training and education provide the means for the Army to increase the future productivity of its workforce. This, in Becker's (1962) view, is applying current resources against future returns. Since workforce attrition is difficult to predict, knowing exactly who will leave the Army and when they will leave is nearly impossible, the Army generally educates everyone selected for promotion. Not all leaders selected for promotion attend in-residence courses. Becker (1962), bases this increase in human capital through education on two conditions, as described by Wardynski et al. (2009):

This increase in human capital presupposes two conditions that are not always met: first, that the employees are *good ones* focused upon being as productive as possible; and second, that the employees are working within a competency area that aligns with their human capital. (p. 3)

The current Army promotion system assumes that the *good ones*, discussed by Wardynski et al. (2009) above, advance because they are indeed working within a competency area that aligns talents, and their demonstrated potential for increased responsibility exceeds that of their peers (Wardynski et al., 2009). A holistic valuation of Army human capital programs includes methods to develop the cognitive, physical, and social components (DA, 2014c). Human capital theory purports that Army leaders who possess deeper levels of knowledge, skills, and behaviors will achieve higher performance levels than those who possess lower performance levels (Ployhart & Moliterno, 2011; Wardynski et al., 2009). If investments in human capital raise a worker's productivity (Becker, 1993), one must examine what it is the Army needs to produce. The Army states that leaders must be talented critical thinkers, decision makers, and problem solvers. One of the most effective methods of developing critical thinking skills is explicitly teaching them in the classroom (Abrami et al., 2008). The Army must teach cognitive processes at every level for the Army to gain cognitive advantage over the Nation's adversaries. Human capital theory (Becker, 1993) guides this study to inform the Army on how to develop critical thinking skills through education, as human capital theory maintains education is the most important investment in human capital.

#### *Human Resource Development Theory*

Building upon Becker's economic perspective of human capital, human resource development and its underlying theory (Swanson, 2001) examined economics as an essential element of human resource development theory. Sowell (2014) defined economics as "both the study of the use of scarce resources that have alternative uses" (p. 2), and as "the study of consequences of various ways of allocating scarce resources that

have alternative uses” (p. 3). The total number of soldiers allowed in the Army at any given time is legislatively prescriptive, therefore human capital in the Army is indeed a scarce resource, and human capital is certainly a resource with alternative uses in a volunteer Army. All organizations (profit, nonprofit, & government) are economically based entities that require human resource development to maintain and improve their systems (Swanson & Holton, 2009). It is within this economic component that Swanson (2001) viewed human resource development as the efficient and effective utilization of limited resources to achieve organizational goals. Wardynski et al. (2009), echo this economic viewpoint, as they stated, “all people have talent which should be identified and liberated, and that they can dramatically and continuously extend their talent advantage if properly incentivized, developed, and employed.” (p. 4)

This research will explore the critical thinking talent of Army officers, a population which economics identifies as a limited resource. Army officers, in economic terms, are a limited resource because U.S. law limits the number of officers authorized in the Army’s workforce, and promotions only come from within this limited population. Scarce resources, including human resources, must have efficient and effective utilization in order to achieve organizational goals (Swanson, 2001). The Army, as in most organizations, consists of people who provide the human expertise enabling the Army to accomplish its mission. In support of the Army strategy to optimize human performance, human resource development theory (Swanson, 2008) describes how the Army can fully optimize human performance by unleashing the expertise of its leaders. Utilizing expertise developed through investment supports Becker’s human capital theory in that the individual is not capital per se, but the capital lies in the value of what they are able to

intellectually or physically produce (Becker, 1993). Human resource development theory purports that “human resource development is a process that develops and unleashes human expertise for the purpose of improving performance” (Swanson & Holton, 2009, p. 99). Human resource development focuses on developing solutions to problems. The ability to solve complex problems transitions into the cognitive domain of critical thinking. Since this study measured levels of critical thinking talent, it is important to understand the theoretical foundations of critical thinking.

### *Critical Thinking Construct*

This study reviewed critical thinking disposition and critical thinking skill, as necessary for talented critical thinking practice (Facione, 1990). Since the Army states that critical thinking is one of the most important competencies leaders must possess (Allen & Gerras, 2009; DA, 2011; Fischer et al., 2009), this study measured the perceived critical thinking disposition and skill of junior Army officers. In the examination of both critical thinking disposition and critical thinking skill, it is necessary to review the construct of critical thinking pertinent to the current study.

The construct of critical thinking and associated skills is a topic of extensive research and continued debate. The debate centers on the various methods used to describe critical thinking relative to the context of the discipline. Within the human capital development domain, this section will focus on the various definitions of critical thinking, most of which extend from the two disciplines that encompass higher order thinking; philosophy and psychology (Halpern, 1998, 2001c; Lewis & Smith, 1993). These two disciplines frame both the potential of one to be a successful critical thinker, and the actual behavior of thinking critically. According to Snow (1964), these two

disciplines reflect the fields of the humanities (philosophy) and the sciences (psychology), both providing significant contributions to the field of higher order thinking (Lewis & Smith, 1993). These two disciplines capture the essence of what Facione (1990) describes as both the *willingness* and the *ability* to think critically. One may indeed have the cognitive skills necessary to develop and analyze arguments (Facione, 1984); however, without the disposition to do so, critical thinking outcomes are less likely to emerge.

This study measured junior Army officer willingness to engage in critical thought as well as critical thinking skill. Although the literature contends that critical thinking, problem solving, and evaluation should not be used interchangeably (Beyer, 1985; Ennis, 1962; Facione, 1984; Lewis & Smith, 1993) and are distinctly different skills (Ennis, 1985; Facione, 1990; Halpern, 1998), none of these competencies can develop without a disposition to use them (Facione, 1990; Miller & Tucker, 2015; Tiwari, Lai, So, & Yuen, 2006). What the Army wants in leaders is the ability to engage in cognitive behaviors described by the critical thinking theorists. To discuss the habit of mind to engage in a broad spectrum of intellectual behaviors, the discussion below describes critical thinking talent according to major theorists in the field of critical thinking.

The U.S. Department of Education and the American Philosophical Association sponsored a two-year Delphi study in 1990 that sought a consensus, identifying the skills and dispositions that characterize critical thinking, and a means to assess critical thinking (Facione, 1990). The consensus definition of critical thinking developed by participants in the Delphi study identifies characteristics of the ideal critical thinker. These competencies include being “inquisitive, fair-minded, flexible, diligent, and focused in

inquiry” (Giancarlo & Facione, 2001, p. 31). These characteristics of the ideal critical thinker are the framework for the psychometrics utilized in the current research (Facione & Facione, 1992). The Department of Education and American Philosophical Association Delphi report Consensus Statement (Facione, 1990) on critical thinking stated,

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. CT is essential as a tool of inquiry. Thus, educating good critical thinkers means working toward this ideal. It combines developing CT skills with nurturing those dispositions which consistently yield useful insights and which are the basis of a rational and democratic society. (p. 3)

In the pursuit of developing leaders to think critically, it is essential to consider Army workforce members’ disposition to think critically, that is, the students’ state of cognitive readiness to engage in critical thought (P.A. Facione, Sanchez, Facione, & Gainen, 1995). A necessary element of enabling the development of higher-level thinking includes an examination of the habit of mind to engage in critical thought (Colucciello, 1999). In the context of this research, the term higher-order thinking skills loosely correlates with the top three levels of Bloom’s taxonomy (Bloom, 1984; Krathwohl, 2002), a relationship discussed by Ennis (1985). Critical thinking ability is fundamentally different from one’s willingness to make critical thinking a habit of mind (Giancarlo & Facione, 2001; Facione, Facione, & Giancarlo, 2000). One may have the skills to be a critical thinker,

but may not habitually use those skills. Researchers have examined critical thinking disposition for some time for its important relationship to critical thinking (Ennis, 1962; Miller & Tucker, 2015). Developing the willingness to engage in critical thought is fundamental to improving the use of critical thinking in the operating environment (Tiwari et al., 2006). This study focused on what Facione (1990) referred to as the willingness to think critically, or critical thinking disposition, and critical thinking skill. Army leaders must possess the trait described by Facione (1990), as the habit of mind to engage in purposeful, self-regulatory judgment. According to the Association of American Colleges and Universities, one of the fundamental expectations of higher education is the development of critically thinking college graduates (AAC&U, 2011; Lampert, 2007; Liu et al., 2014). The Army plans to develop the cognitive skills necessary for its workforce to become effective critical thinkers through the Army Learning Concept.

#### *Critical Thinking and the Army Learning Concept*

In 2011, the Army adopted a new foundation for the development of soldier and leader learning, known as the Army Learning Concept 2015 (DA, 2011). This model transitions the methods in which the Army creates and transfers knowledge to students (DA, 2011). The Army will transition from instructor-led, lecture-style methods of instruction to a learner-centered, experiential methodology facilitated by subject matter experts (DA, 2011). This model fosters the higher level thinking skills necessary for critical thought and complex problem solving (DA 2011; Ennis, 1993). Instructional techniques such as action learning should also be considered by the Army for developing critical thinking talent in an organizational context (Yeo & Marquardt, 2015).



Before education institutions deliver effective critical thinking instruction, educators must identify learning outcomes, and those outcomes should derive from evidence-based modeling of critical thinking (Fischer et al., 2009). Army education communities of practice must have an understanding of the willingness of their students to think critically as well as their level of critical thinking skill in order to develop curricula to improve their critical thinking talent. Ennis (1993) stated that if educators are to know where to focus critical thinking education, then educators must know the level of student critical thinking. Faculty must also have a deep understanding of students' critical thinking related skills in order to be able to teach and measure their success (Brookfield, 1995). Critical thinking may be a teachable skill that improves through instruction (Facione, 1990); however, the act of thinking does not ensure high quality thinking or sound judgment (Lizzio & Wilson, 2007; Paul & Elder, 2006).

The Army must consider other skills that foster critical thinking expertise. Future Army leaders operate in situations of uncertainty, where a capability to engage in critical thought is a necessity (Franke, 2011; Miller & Tucker, 2015; Thomas & Gentzler, 2013). Using the cognitive skills essential to critical thinking increases the probability of a desired outcome (Franke, 2011; Halpern, 2003).

#### Critical Thinking Theorists

In the future, Army leaders will find themselves in the position where they must arrive at a decision based on information that is incomplete, uncertain, and often intentionally misleading (Fischer et al., 2009). Whether preventing conflict, shaping the security environment, or engaged in combat, leaders require developed critical thinking skills to operate successfully in a chaotic environment (Moilanen, 2015; Thomas &

Gentzler, 2013). There is no dominant model or theory of critical thinking, and much of critical thinking research can be found in psychological and philosophical, and education literature (Fischer et al., 2009). To form a better understanding of the critical thinking construct used in this study, it is necessary to review the themes of prominent critical thinking theorists.

### *John Dewey*

John Dewey was an American Philosopher and educator often considered the father of modern critical thinking (Fisher, 2011). Dewey (1933) described critical thinking as reflective thought, and wrote extensively on the importance of thinking reflectively. Dewey (1933) examined the process of reflection as a very complex, active process. Fisher (2011) highlights that Dewey was very specific in defining critical thinking as an active process, one that Dewey stated was persistent and careful. In her article on Dewey and reflective thinking, Rogers (2002) distilled down four criteria that summarize Dewey's (1933) framework of reflection. Rogers (2002) identifies these four reflection criteria as "(a) reflection is a process of making meaning of experience, (b) reflection is based in the scientific method, with rigor and discipline, (c) reflection cannot happen in isolation, but with others, and (d) reflection requires one to value the growth, both intellectually and personally, of not only themselves, but others" (p. 845). These four reflection criterion are distinct and systematic, and require cognitive and emotional discipline (Rogers, 2002). Critical thought is indeed an intellectual and emotional endeavor (Dewey, 1933). Critical thinking involves reflection, as the "active, persistent, and careful consideration of any belief or supposed form of knowledge in light of the grounds that support it and the future conclusions to which it tends" (Dewey, 1933, p. 7).

Dewey (1933) contends that reasoning surrounds critical thought, and it is those reasons we believe things and what those beliefs involve that is the characteristics of the reflective critical thinker.

*Robert Ennis*

Ennis (1962) framed critical thinking through informal logic, a variation of argumentation theory. This set of theories, dating back to ancient Greece, assesses claims and analyzes arguments through logic. Ennis (1985) does not subscribe to “higher order thinking skills” as an acceptable term for the development of students. The term *higher-order thinking skills*, according to Ennis (1985), refer to Bloom’s (1956) taxonomy of cognitive learning domains. The top three levels of Bloom’s (1956) taxonomy of cognitive learning, analysis, synthesis, and evaluation, are the highest learning objectives within an education setting, and used during curriculum design. This classification of cognitive processes builds upon the previous ability. As an example, one of the most basic cognitive processes according to this taxonomy is rote memorization. A junior Army officer attending a professional military education course may be told to memorize the steps of the military decision making process. Memorization, however, does not cognitively develop the student with depth and comprehension of the decision-making process, nor does it create the knowledge required to apply the process intuitively in the operating environment, as memorization is a low-level cognitive skill. Levels of thinking skills are often a reference to Bloom’s taxonomy of learning domains. However, Ennis believes that higher order thinking skills is a term too vague to be of use to curricula and evaluation developers (Ennis, 1985). Regarding the practical elements of critical thinking, Ennis (1985) states that “deciding what to believe or do is a higher-order

thinking enterprise, and most practical higher-order thinking activity is focused on deciding what to believe or do” (p. 47). The act of thinking about, and then deciding what to believe or do is practical activity (Ennis, 1985). As a practical activity essential to critical thinking, Ennis (1985) explains the need for more specific criteria to support teaching activities. From his philosophical point of view above, Ennis (1985) defines critical thinking as “reflective and reasonable thinking that is focused on deciding what to believe or do” (p. 45). This view of the practicality of higher order thinking frames Ennis’ sets of abilities that he states are necessary for critical thinking. Ennis was a participating critical thinking expert on the 1990 APA Delphi study on critical thinking (Facione, 1990).

*Richard Paul*

A prominent philosopher and critical thinking theorist is Richard Paul. His views of critical thinking focus on the use of intellectual analysis and assessment of reasoning (Foundation for Critical Thinking, 2015a). Paul purports that although it is indeed the nature of humans to think, it is not the nature of humans to think well (Paul, 1993). The definition of critical thinking put forward by Paul (2003) is “the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action” (para. 1). This definition indicates Paul’s view of critical thinking as a methodical process, which follows five elements of critical thinking. Paul identifies these five elements as the “analysis of thought, the assessment of thought, the dispositions of thought, the skills and abilities of thought, and the obstacles to critical thought” (Foundation for Critical

Thinking, 2015a, para. 4). Gerras (2008) proposed a derivative of the Paul and Elder model, stating that critical thinking requires conscious effort, and is not intuitive.

According to Gerras (2008), most decision-making done each day requires little, if any, critical thought. He uses the term *automatic thought* to describe the low cognitive energy directed at mundane, less essential decisions. Critical thought, in the Paul definition, is thinking about thinking. Paul and Elder (2006) write that one must break down their thinking into elements of thought, and then improve the intellectual qualities of them. As an example, Paul and Elder (2006), in their critical thinking learning model describe the elements of critical thought with a significant focus on reasoning. They describe these elements as: reasoning has purpose; reasoning attempts to gather knowledge; basing reasoning on assumptions; those that reason do so from a specific point of view; reasoning is evidence-based; one expresses reasoning conceptually; reasoning contains inferences; and reasoning leads to outcomes with consequences (Paul & Elder, 2006).

Paul developed numerous assessments of critical thinking (Foundation for Critical Thinking, 2015b). In current use is the International Critical Thinking Basic Concepts and Understanding Online Test (Foundation for Critical Thinking, 2015c). One of his contributions to critical thinking education familiar to many military education students (Williams, 2013), is the *Miniature Guide to Critical Thinking* (Foundation for Critical Thinking, 2015c). The Army often distributes this guide to students attending military education courses (Williams, 2013).

### *Diane Halpern*

A critical thinking theorist who subscribes to the psychology perspective of critical thinking is Halpern. In her viewpoint, the skills necessary for critical thinking are

generalizable across various domains (Halpern, 1998, 2001a). She describes critical thinking as “the use of those cognitive skills or strategies that increases the probability of a desirable outcome. It is the kind of thinking involved in solving problems, formulating inferences, calculating likelihoods, and making decisions” (Halpern, 2001b, p. 254) She describes critical thinking as purposeful, reasoned, and goal-directed, and that critical thinkers use these competencies consciously (Halpern, 1998). As discussed earlier with Ennis (1985), Halpern (1998) associates critical thinking skills comparatively to the highest levels of Bloom’s taxonomy only to articulate that these skills are complex, and require application in a cognitive manner. In Halpern’s model, critical thinking is essential for solving complex problems with ill-defined solutions (Halpern, 2001c; Williams, 2013). Halpern (1998) believes that the goal of critical thinking instruction is to teach one to be aware of and shape one’s own thinking. Halpern (1998) acknowledges the vast literature on critical thinking, and the various types of knowledge to which the term applies. Halpern (2001b) discusses wisdom and values relating to decision-making as an outcome of critical thinking. This is especially relevant to this study, as it examines military officer critical thinking talent. In her article, Halpern (2001b) discusses a hypothetical situation in which a military officer faces a complex situation facing an armed enemy. As described in the article, this officer must contend with values, both personal and organizational, in his decision-making. Knowing the desired outcome is an essential element of critical thinking, for it shapes the possible methods of achieving the outcome. McMaster (2015) stresses the importance of knowing what the sustainable political outcomes of conflict may be, in order to develop military strategies to achieve them. Halpern (1998) cites cognitive psychology as the foundation for a four-part model

to teach thinking skills across different domains. These four parts are, “(a) a dispositional or attitudinal component, (b) instruction in and practice with critical thinking skills, (c) structure-training activities designed to facilitate transfer across contexts, and (d) a metacognitive component used to direct and assess thinking” (Halpern, 1998, p. 451). Halpern (1998) asserts the importance of differentiating the disposition to think critically from critical thinking skill. Pertinent to the current study, Halpern (2001a) cites numerous studies where focused instruction develops critical thinking skill. Perceived levels of critical thinking disposition and skill are the focus of this research, and the next section discusses Facione, the developer of the instruments that will measure critical thinking disposition and skill in this study.

#### *Peter Facione*

Another theorist who holds the philosophical view relative to critical thinking is Facione, who was the principal researcher on the American Philosophical Association (APA) Delphi Study on critical thinking (Facione, 1990). The APA study (Facione, 1990), conducted over a two-year period, utilized a qualitative design Delphi method to gain a consensus resolution of matters of opinion on critical thinking. The intent of this study was to provide an accurate conceptualization of critical thinking for use in developing assessment tools and instructional programs (Facione, 1990). Experts participating in the Delphi study (Facione, 1990) acknowledged at the study’s outset that a clear conceptualization of critical thinking was elusive, and had consistently hindered critical thinking efforts in education. A relevant point by Dewey (1933), describing the importance of the habit of mind to engage in critical thought stated, “If we were compelled to make a choice between these personal attributes and knowledge about the

principles of logical reasoning together with some degree of technical skill in manipulating special logical processes, we should decide for the former.” (p. 34)

One of the principle goals of the APA Delphi study was to examine good critical thinking that includes skills across two dimensions, a cognitive dimension and an affective dimension (Facione, 1990). In this context, the cognitive dimension refers to the skills identified as necessary to be a good critical thinker, such as interpretation, self-regulation, analysis, evaluation, and inference (Facione, 1990; Rowles, Morgan, Burns, & Merchant, 2013). The affective dimension refers to the dispositions that characterize the critical thinker, such as open-mindedness, honesty, trustworthiness, and inquisitiveness (Facione, 1990). As discussed earlier, these two dimensions frame the philosophical (affective) approach to critical thinking as well as the psychological (cognitive) approach. However, the experts in the study were clear to point out that “good critical thinking is not rote, mechanical and unreflective, disconnected execution of sundry cognitive processes and they caution not to lose sight of the whole while attempting to attend well to its many parts” (Facione 1990, p. 8). By combining both the philosophical and psychological theorists’ definitions of the critical thinking, Facione (1990) was able to develop a more holistic conceptualization of critical thinking, incorporating both the willingness and ability to think critically (Snyder & Wiles, 2015). Ennis and Paul were members of the expert panel of critical thinkers during the 1990 APA Delphi study.

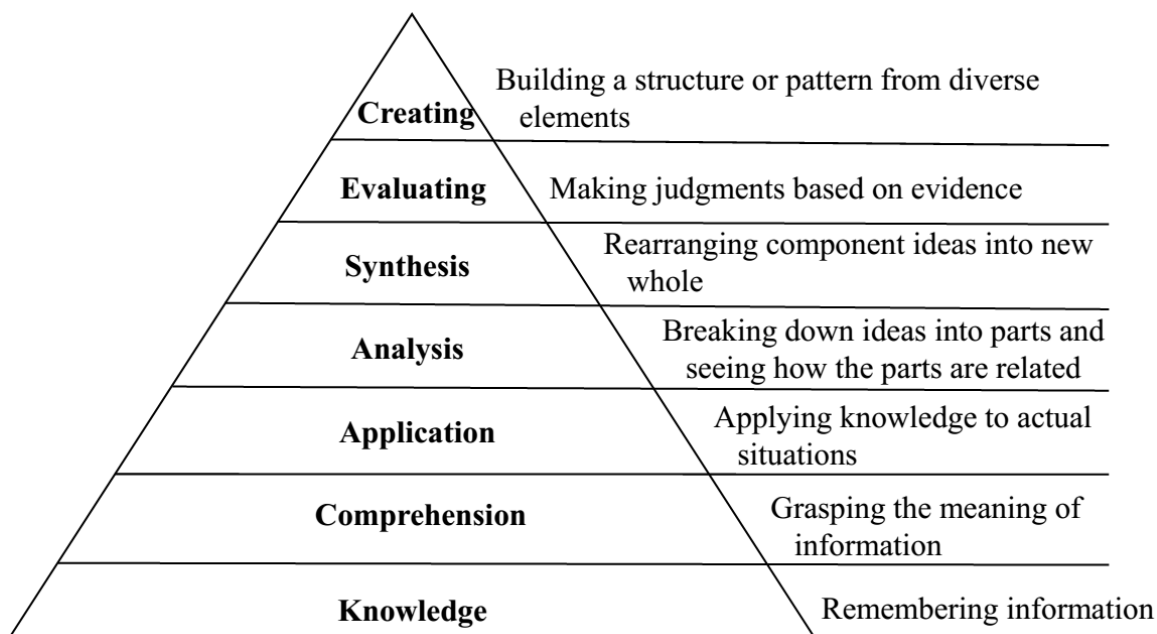
The APA Delphi consensus statement regarding critical thinking and the ideal critical thinker described critical thinking as “purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or conceptual considerations upon



which that judgment is based” (Facione, 1990, p. 3). As determined in this study “a person engaged in critical thinking uses the fundamental set of cognitive skills of analysis, interpretation, inference, explanation, evaluation, and self-regulation (P.A. Facione et al., 1995, p. 3). Very similar to Ennis’ (1985) definition, Facione describes critical thinking as a process that one uses to form a judgment about what to believe or what to do (P.A. Facione et al., 1995). Facione’s (1990) construct for critical thinking disposition and skill is the guiding framework for this study

### *Bloom’s Taxonomy and Critical Thinking*

One of the most significant and lasting influences on education literature is the classification of cognitive skills identified in Bloom’s (1984) work on the taxonomy of educational objectives (Adams, 2014). Frequently utilized for the development of educational objectives, Bloom’s (1984) framework organized six categories within the cognitive domain, which were ordered from the simple to intricate, and from concrete to theoretical (Krathwohl, 2002). Used as a conceptualization of higher order thinking skills, Bloom’s taxonomy is for *classifying* educational objectives, not as a *statement* of education objectives (Ennis, 1985). The categorization of higher- and lower-order thinking skills arose later, as Bloom did not develop this differentiation (Adams, 2014). Literature often conceptualizes Bloom’s (1984) taxonomy as a familiar two-dimensional pyramid where the skills that require more cognitive skill are higher on the taxonomy pyramid of educational objectives (Ennis, 1985; Tsui, 2008). The U.S. military services define the various levels of knowledge representative of Bloom’s taxonomy in the context of possible levels of learning, as illustrated in Figure 2.



*Figure 2.* Levels of Learning Achievement. This illustration represents an interpretation of the useful hierarchy of possible levels of learning in the cognitive domain described in Appendix A to Enclosure E of the Chairman of the Joint Chiefs of Staff Instruction for Officer Professional Military Education Policy.

Ennis (1985) reviewed Bloom citing no criterion accompanies the taxonomy for judging the outcomes for each cognitive activity. Ennis (1993) was critical of Bloom's Taxonomy in the lack of specificity within the taxonomy relative to critical thinking. In another critique of Bloom's Taxonomy, Paul (1985) states that Bloom's taxonomies of cognitive and affective domains attempt to achieve a neutral classification of these processes. However, the cognitive skills forming the framework of critical thinking include analysis, evaluation, and interpretation, are consistent with the highest levels in Bloom's Taxonomy of the cognitive learning domain (Facione, 2015). A cognitive hierarchy such as Bloom's Taxonomy is important in education literature as the outcome of higher education is to reach beyond the acquisition and processing of knowledge and advance to a conceptualization of critical thinking as intellectual practice where one objectively judges their own thinking (Paul, Elder, & Bartell, 1997).

In the context of learning outcomes within the military, understanding hierarchal levels of learning achievement allows the military education enterprise to develop progressive and sequential learning experiences. To improve Army officers' ability to engage in critical thought in a complex environment requires instruction designed specifically to enhance critical thinking disposition and skill (Ennis, 1993; Facione, 2015; Halpern, 2001c). To understand how analysis, synthesis, and evaluation as higher-order cognitive skills where critical thinking takes place, one must understand the willingness and habit of mind to utilize these skills.

#### *Critical Thinking Habits of Mind*

Good critical thinking stems from the willingness to engage in critical thought (Facione, 1990). Critical thinking disposition, described as the consistent internal motivation to engage in critical thought (Facione, Facione, & Giancarlo, 2000), or the tendency to do something given certain conditions, and to do so reflectively (Ennis, 1985), is a separate but essential component of the conceptualization of critical thinking. Halpern (2003, 2010) claimed that critical thinking is collectively the combination of critical thinking skills and a disposition towards engaging in the process of reason. The U.S. Department of Education and the American Philosophical Association sponsored a two-year Delphi study in 1990 that sought a consensus, which identified the skills and dispositions that characterize critical thinking, and a means to assess critical thinking (Facione, 1990). Since the Army wants to improve critical thinking across its workforce, it may be beneficial for the Army to understand both critical thinking disposition and skill, as well as methods to assess levels of critical thinking talent (Halpern & Nummedal, 1995).

### *Critical Thinking in the Army*

The U.S. Army War College is one of several senior service colleges within the Department of Defense. The purpose of these senior service colleges is to provide quality strategic-level education to senior military leaders. The Chief of Staff of the Army developed special interest topics for the U.S. Army War College Key Strategic Issues List (U.S. Army War College, 2014). The Strategic Studies Institute is a subordinate organization of the Army War College, and is the U.S. Army's institute for national security and research analysis (U.S. Army War College, 2015a). The Strategic Studies Institute publishes the Key Strategic Issues List so researchers are aware of topics of special interest to the Army. Included as a special interest topic in both the 2014-15 and the 2015-16 Key Strategic Issues Lists is how the Army can refine its officer education system to improve critical thinking skills (U.S. Army War College, 2014, 2015a). The stated purpose of the Army War College is "to produce graduates from all our courses who are skilled critical thinkers and problem solvers in the global application of landpower" (U.S. Army War College, 2015b).

An objective review of the Army budget for 2015 and beyond clearly shows a reduction in resources and deferred modernization programs (DA, 2014c). Smaller budgets and older equipment will require more adaptability and creative problem solving in Army leaders. A review of the literature shows that one of the most important competencies of effective Army leaders is the ability to think critically (Allen & Gerras, 2009; Fischer et al., 2008; Gerras, 2006; Thomas & Gentzler, 2013, U.S. Army War College, 2015b). The ability to objectively examine evidence and solve complex problems requires traits such as high-level thinking, and the Army must teach these skills

to its leaders. In order to teach these skills effectively, the Army must have some measure of its leaders' willingness to think critically.

As discussed in military literature, critical thinking is at the core of leadership (Fischer et al., 2008) and is one of the key antecedents to strategic thinking (Allen & Gerras, 2009). The Army (DA, 2014a) acknowledges that its future operating environment is unpredictable, therefore its leaders must be prepared to thrive in uncertain environments where critical thinking is required (Thomas & Gentzler, 2013). Army leaders must be prepared to function in uncertain operating environments where clear solutions to problems are not evident. A review of military literature shows extensive research on the importance of Army leaders to be talented critical thinkers (Allen & Gerras, 2009; Fallesen, Keller-Glaze, & Curnow, 2011; Gerras, 2008; Petraeus, 2007; Thomas & Gentzler, 2013). Therefore, the purpose of this study was to address a gap in the literature by measuring the perceived level of critical thinking talent of two groups of junior Army officers with different levels of education. Extensive research of critical thinking disposition and skill is evident across healthcare and education literature, but scarce research exists in the critical thinking disposition and skill of U.S. Army leaders. If the Army is to improve critical thinking talent across its workforce, the Army could develop critical thinking strategies through its own education resources.

#### *Critical Thinking in Higher Education*

The current study built upon findings from critical thinking research that found the number of years of education predicts critical thinking scores, rather than respondent age (Butler, 2012). Among social work students, Simmons (2014) found that education was a significant predictor of cognitive complexity, and age and experience were not

significant. The U.S. Department of Defense is the largest employer in the United States, and is the largest provider of adult education (Persyn & Polson, 2012). All branches of the U.S. military require applicants to possess a 4-year college degree for commissioning as an officer. In order to be successful, all branches of the military require their members be adaptive and thinking professionals (Joint Chiefs of Staff, 2011). The Army develops leaders through progressive and sequential education across a continuum of lifelong learning. Across this learning continuum, Army leaders develop the cognitive skills required to lead through ambiguity and chaos through education, training, and experiential opportunities (DA, 2013). The Association of American Colleges and Universities state one of the principal outcomes of liberal education is the development of cognitive skills such as critical thinking (AAC&U, 2011). The Army officer education system consists of formal resident and non-resident courses of instruction designed to develop cognitive ability in students. Talented military and civilian professors with deep subject matter expertise facilitate both resident and non-resident delivery methods of education. The role of these experts is to create knowledge and ensure they meet the learning outcomes of the lessons, as well as develop student problem solving ability (Bransford, Brown, & Cocking, 2000). The Army goal is to teach leaders *how* to think, not *what* to think, within courses of professional military education (N.C. Facione, & P.A. Facione, 1996; Thomas & Gentzler, 2013; Wardynski et al., 2009). Critical thinking is one of the most important outcomes of education, and rich research is available regarding the importance of critical thinking skill as an outcome of higher education (Abrami et al., 2008; Behar-Hohenstein & Niu, 2011; Duron et al., 2006; Facione, 1990; Halpern, 1999; Liu et al., 2014; Nusche, 2008; Paul & Elder, 2001; Pellegrino & Hilton,

2012; Tiruneh et al., 2014). The challenge the Army faces is most members of the Army military workforce do not possess a college degree.

If the Army requires its workforce to be talented critical thinkers, some element of critical thinking instruction should take place within the leader development continuum. What the Army does not know is the current level of critical thinking talent across the Army workforce. In order to create effective curricula that develop critical thinking talent, the Army needs some baseline metric of Army leader critical thinking disposition and skill. The literature is indeed rich with research on college education as a method for developing critical thinking talent (Halpern, 1998; Ennis, 1993), however, the majority (78%) of the Army workforce does not possess a college degree (Table 1). Indeed, the entire Army officer corps represents less than 5% of the total of male college graduates in the United States (Wardynski et al., 2009). Due to the large number of Army personnel with no 4-year degree, professional military education may be the preferred method for the Army to developing critical thinking talent across its workforce.

Table 1

*Level of Education of Active Duty Army Members*

Level of Education	<i>N</i>	Percentage
No High School Diploma or GED	3,623	0.3%
High School Diploma or GED	1,065,545	77.8%
Bachelor's Degree	166,679	12.2%
Advanced Degree	105,516	7.7%

Note. Data cited in *2013 Demographics: Profile of the Military Community* (Department of Defense, 2013). *N* = 1,370,329.

Although literature shows critical thinking as one of the most important outcomes of college education (Behar-Hohenstein & Niu, 2011; Facione, 1990; Pellegrino &

Hilton, 2012; Paul & Elder, 2001), few will argue that not all college graduates emerge a critical thinker. Discussed in Flores et al. (2012), deficient critical thinking limits leader development, and college education does not develop critical thinking skills as expected (Atherton, 2014). Optimizing cognitive performance through human dimension initiatives may allow the Army to mitigate this gap in critical thinking talent.

### *The Human Dimension*

Army leaders require a foundational understanding that fighting wars is a human endeavor, and “the most powerful tool any soldier carries is not his weapon, but his mind” (Petraeus, 2007, para. 2). Advanced weapons systems such as helicopters, precision-guided munitions, and armored vehicles are only enablers, as they do not operate themselves, nor do they plan military operations. The Nation’s adversaries continue to develop strategies to counter the technological advantage enjoyed by the U.S. military. The Army cannot become over-reliant on technology (McMaster, 2015), and must continue to develop leaders in order to retain cognitive overmatch through the human dimension. The Army's human dimension concept has three lines of effort that serve as components to gain competitive advantage over an adaptive and increasingly capable enemy: agile and adaptive leaders, institutional agility, and superior training. The current study focuses on the agile and adaptive leader component, which focuses on cognitive development. In order to achieve cognitive advantage over the nation’s adversaries, Army leaders must be talented critical thinkers able to solve complex problems, and be able to make sound, reasoned decisions (DA, 2014b; Dietz & Schroeder, 2012; Fischer et al., 2008, 2009; Thomas & Gentzler, 2013).



The human element of conflict exacerbates the future operating environment, as the Army describes in its Operating Concept (DA, 2014b) and Human Dimension Concept (DA, 2014a). These concepts describe war as both an extension of politics and as a competition between groups. This competition between groups is a human endeavor, where conflict manifests itself as battles in the land, sea, air, space, and cyber domains (McMaster, 2015). The outcome of these battles shape the overarching political desires of groups, which is fundamentally why nations engage in conflict in the first place. McMaster (2015) describes the rationale for why groups fight today as no different from what motivated groups to fight 2,500 years ago when he references Thucydides' three reasons why nations fight: fear, honor, and self-interest. It is essential for Army leaders to understand these motivations and incentives of conflict, as they are human in nature (DA, 2014b; McMaster, 2015). It must be through adaptive leader development strategies that enable Army leaders to understand the human dimension of war that the Army will gain a cognitive advantage over its adversaries. Tailored leader development strategies will enable Army leaders to begin to understand the inherently human, non-linear nature of conflict and its associated complexity. Army leaders should study and discuss these complex topics in a classroom setting, where discourse and debate are encouraged, which leads to a deeper understanding of these complex topics (DA, 2013). Through professional military education, the Army shapes the curricula required to achieve learning outcomes that support a foundational understanding of the Army's complex operating environment (DA, 2013, 2014a). Understanding the theoretical foundations of human capital development will help the Army form strategies to achieve desired learning outcomes.

Within the Army human dimension operational approach, this study will explore critical thinking disposition and skill as a method to achieving cognitive advantage for the Army. By optimizing workforce performance through improved critical thinking, the Army can achieve cognitive advantage as a method for gaining competitive advantage against the Nations adversaries. Army leader development processes should focus on improving critical thinking talent

### Developing Army Leaders

The foundational assumption across Army's leader development processes is that leadership, and developing leadership talent, can indeed be taught and developed (DA, 2012; Halpern, 1998). The Army develops agile and adaptive leaders through training, education, and experience (DA, 2012), and these three processes are at the core of Becker's (1993) Human Capital Theory. In examining the total Army as a homogenous workforce, Becker (1993) states that leaders add value to its workforce by developing its human capital through investment in education. Military education adds value to its officer corps through developing cognitive ability in its leaders and certifies each officer's expertise prior to assuming positions of increased responsibility (Colarusso & Lyle, 2014). Simmons (2014) found that life experience by itself may not be sufficient in developing cognitive skill, and that education was the most significant factor related to cognitive development. Critical thinking education facilitates cognitive development and can improve logical reasoning and decision-making skills. The Army develops leaders through training, education, and experience (DA, 2013). Training is what the Army does continuously to build confident, talented soldiers and teams (DA, 2014d). Army leaders participate in training exercises and gain experience both through training events and

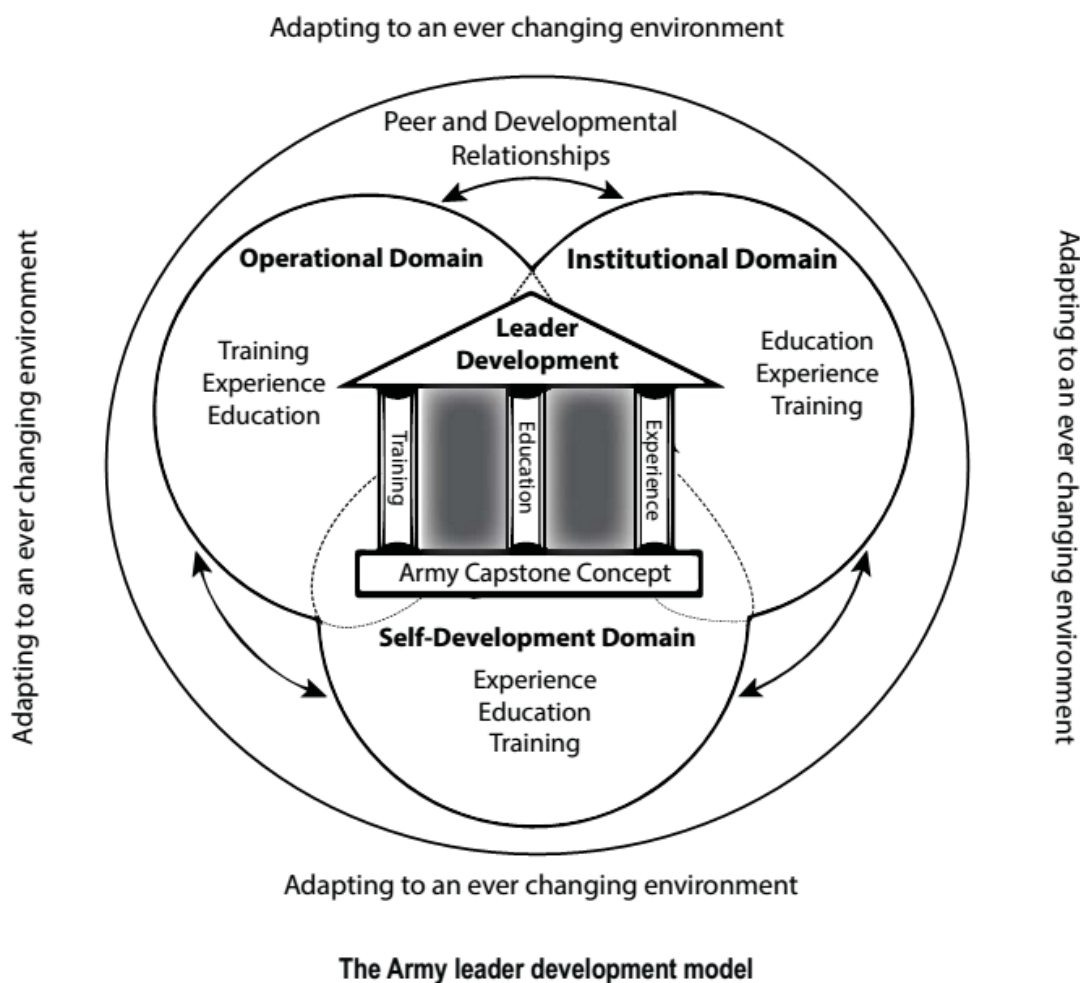
through operational missions. Much of the learning gained from training and experiential methods occurs outside the classroom in real world operations and field environments.

### *Army Leader Development*

The Army prepares officers for leadership roles through the Army Leader Development Strategy, a framework for leader development through training, education, and experience (DA, 2013). Progressive and sequential education is a fundamental component of leader development, and the Army develops the cognitive talent of its leaders through courses of professional military education. The purpose of military education is to “convey a body of professional knowledge and establish the habits of mind essential to our profession” (CJCS, 2015, p. 1). Military education courses both complement and parallel civilian education courses, and their end states are to achieve similar education outcomes. Critical thinking talent developed through education should be a foundational part of military leaders’ development if the Army is to achieve cognitive dominance over future adversaries.

Army leader development is a “deliberate, continuous, sequential, and progressive process” (DA, 2014d, p. 2) which takes place in the institutional, operational, and self-development domains (DA, 2014d). This study focuses on the education component of Army leader development, which the Army conducts formally inside a classroom environment. Education can improve critical thinking disposition and skill (Ennis, 1985; Facione, 2000; Halpern, 1999, 2001b; Williams, 2013). Since the Army wants its leaders to be talented critical thinkers, the Army should consider improving critical thinking education as an essential part of the Army leader development strategy. Figure 3 illustrates the Army leader development strategy and the relationship of education to the

institutional domain. Army educational institutions should prepare to improve and develop the level of critical thinking talent of its students, which will achieve valued critical thinking outcomes.



*Figure 3.* The Army leader development model. This model, as illustrated in the Army Leader Development Strategy 2013, describes training, education, and experience as the three pillars of leader development, and their relationship to the three domains of Army learning. This illustration is in the public domain.

Within the scope of education, the Army fundamentally develops leaders to become expert critical thinkers. As an example, the Army's Advanced Operations Course provides mid-career officers the cognitive skills required of field-grade leaders, such as critical thinking and complex problem analysis (Straus et al., 2013). The Army

seeks, as one of the outcomes of higher education, to get students outside of their comfort zone in the classroom (Petraeus, 2007), which raises the intellectual capital of the officer corps. The Army requires a force capable of maintaining a credible, robust capacity to win decisively (DA, 2012b). In order for Army leaders to set conditions for success in such environments, a capacity for critical thinking is required (Thomas & Gentzler, 2013).

The Army's educational institutions, in their charter to produce critical thinkers and complex problem solvers (DA, 2011), should have a deep understanding of student willingness to engage in higher-order thinking. Army education institutions can become more agile and adaptive if they know students' habits of mind. The Army does not assess student critical thinking disposition, and the literature continues to challenge the professional military education system and its ability to create critical thinkers.

Over a decade ago, in his monograph on the Army's culture of innovation, Brigadier General David Fastabend commented on the Army's culture of critical thinking behavior. He asserts that although most Army schools profess to teach students how to think, as opposed to what to think, he strongly disagrees (Fastabend & Simpson, 2004). Carafano (2009) stated in his testimony before Congress that "the attribute most needed by military officers is the critical thinking skills that come from a graduate education program" (para. 14). The ability of the Army to quickly adapt to meet the changing needs of its leaders is what the Army calls institutional agility, and is critical to optimizing workforce performance (DA, 2014b). The Army must be aware of the cognitive capabilities of its leaders, and examine their disposition to think critically, and develop this essential competency across the continuum of education. Throughout the

leader development process, the Army should consider evidence that collegiate education is not preparing many graduates to meet the critical thinking expectations of the workforce (Flores et al., 2012; A.R. Saavedra & Saavedra, 2011). Army leader development strategies should mitigate the gap in critical thinking education.

The three components of Army leader development are training, education, and experience (DA, 2013). This study focuses on the education component of leader development, and how the Army can create cognitive advantage through improved critical thinking. The Army can develop critical thinking disposition, as well as critical thinking skill, within the classroom. During the development of curricula for mid-grade officers, including learning goals, objectives, and levels of learning, the Army uses Bloom's (1956, 1994) taxonomy of learning levels. In a study to examine critical thinking skills for Army leaders, Straus et al. (2013) defined the cognitive levels used by the Army, which are knowledge, comprehension, application, analysis, and synthesis. Straus et al. (2013) define these levels as follows:

*Knowledge* – recall of specific information; *comprehension* – understanding the material; *application* – use of knowledge to solve problems; *analysis* – breaking material down into component parts to determine structures and relationships; *synthesis* – integrating parts into a new whole; *evaluation* – judging or weighing by building and using criteria and standards.” (p. 105)

#### Measuring Critical Thinking Talent

The cognitive skills necessary for good problem solving and reasoning are very complex, but are able to be analyzed and measured (Insight Assessment, 2015b). The skills necessary for successful performance in the workplace place even more importance

on the ability to engage in critical thought than ever before (Halpern, 1998). Educational and workforce development programs should objectively demonstrate how they improve critical thinking. This study utilizes the construct of critical thinking as described in the Delphi study on critical thinking (Facione, 1990), and will use the critical thinking instruments derived from the Delphi study.

#### *California Critical Thinking Disposition Inventory*

Talented critical thinkers must possess the habit of mind to use critical thinking skill (Facione, 1990; Halpern & Nummedal, 1995). This habit of mind, or disposition to use the requisite cognitive skill, is necessary for good critical thinking. The California Critical Thinking Disposition Inventory (CCTDI) measures “the disposition to engage problems and make decisions using critical thinking” (Insight Assessment, 2015a, p. 15). Critical thinking theorists support the dispositional aspect of critical thinking as essential to the construct of critical thinking (Ennis, 1985; Facione, 1990; Halpern, 2001b). Critical thinking development must include the disposition to engage in critical thinking, which considers how individuals make meaning an element of critical thought (Colucciello, 1999). To facilitate measuring an affective behavior, the CCTDI measures seven dispositional constructs through 75 items. The CCTDI measures the characteristics that influence an individual’s ability to learn and apply critical thinking skills (Insight Assessment, 2015a). The Army wants to improve the critical thinking disposition of its workforce. In order to train critical thinking disposition, an accurate assessment of the habit of mind of Army leaders to engage in critical thought is necessary to develop effective training and education programs (Insight Assessment, 2015a). A detailed description of the CCTDI follows in Chapter III.

### *California Critical Thinking Skills Test*

The Army wants its leaders to possess sound critical thinking skills (DA, 2013; Fischer et al., 2008, 2009; Gerras, 2008; Hinds & Steele, 2012; Schumm et al., 2010; Thomas & Gentzler, 2013). Talented critical thinkers articulate what they are thinking, and how they came to that conclusion (Facione, 2015). The California Critical Thinking Skills Test (CCTST) is “an objective measure of the core reasoning skills needed for reflective decision-making concerning what to believe or what to do” (Insight Assessment, 2015b, para. 3). The CCTST measures critical thinking skill in a 34-item, multiple-choice instrument that focuses on critical thinking skills essential in collegiate education (Insight Assessment, 2015b). A detailed description of the CCTST follows in Chapter III.

### *Assessments of Critical Thinking*

Numerous instruments are available to measure reasoning skills as indicated throughout the literature. In addition to Facione, critical thinking scholars Ennis, Paul, and Halpern each developed unique tools to assess critical thinking. Ennis used his deep experience in critical thinking research as a foundation for developing several instruments for measuring critical thinking, including the Cornell Critical Thinking Tests (CCTT; Ennis, Millman, & Tomko, 2005), and the Ennis-Weir Critical Thinking Essay Test (Ennis & Weir, 1985). The CCTT has two versions, Level X and Level Z (Ennis et al., 2005). The CCTT Level X version, used to assess students in grades 7-12, is a 71-item multiple-choice instrument designed to assess induction, deduction, source credibility, and assumption identification (Ennis et al., 2005). The CCTT Level Z version, designed for college students and adults, is a 52-item multiple-choice instrument



designed to assess the same aspects as the Level X test, but also measures definition, fallacies, and prediction in experiment planning (Ennis et al., 2005). The Ennis-Weir critical thinking essay test (henceforth the E-W) is not a multiple-choice instrument but a writing assessment that allows participants to justify the reasoning in their responses (Ennis & Weir, 1985). The purpose of the E-W is to evaluate the examinee's ability to formulate an argument (Ennis & Weir, 1985). The E-W measures critical thinking ability in the context of argumentation, where the artificiality of a testing environment is minimized (Ennis & Weir, 1985). An examinee evaluates eight arguments, in which each exemplifies at least one error in reasoning described in the test instructions. The participant evaluates the eight arguments presented, and formulates a response to each. The E-W relies heavily upon interpretation of argument in context, which provides reliability for grading an essay (Ennis & Weir, 1985).

Education literature is critical of many of the existing assessments of critical thinking in that the some of the standardized tests in use do not measure essential critical thinking aspects and processes (Iwaoka, Li, & Rhee, 2010). In their white paper examining critical thinking assessments, Paul and Elder (2007) present strong criticism of current instruments which measure critical thinking. Paul and Elder (2007) purport that numerous critical thinking instruments are in use that do not assess the outcomes desired of educators. Paul and Elder (2007) developed numerous instruments designed to “generate evidence relevant to critical thinking teaching and learning” (p. 6), and one of these is the International Critical Thinking Test (ICTT). This test is a pre- and post-test instrument designed to determine the extent a student has learned to think critically (Foundation for Critical Thinking, 2015c). In the ICTT, participants “must correctly

identify the elements of reasoning within a writing prompt, and then assess, through critical analysis, the reasoning in the original prompt” (Foundation for Critical Thinking, 2015c, para. 6). Recent literature argues that forced choice multiple-choice instruments combined with constructed response items such as the ICTT are better suited to measure critical thinking, as they capture respondent willingness to engage in critical thought (Verburgh, Francois, Elen, & Janssen, 2013), described in the current study as critical thinking disposition.

Halpern’s (2003) discussion of the term “critical” in critical thinking focuses on the evaluative aspect of the term. This focus on evaluating thought processes and outcomes form the foundation of the Halpern Critical Thinking Assessment (HCTA). As a cognitive psychologist, Halpern (2003) recognizes the distinction between instruments that measure *recognition* memory, such as the multiple-choice properties of the CCTDI, CCTST, and CCTT, and *recall* memory, such as the essay properties found in the E-W (Butler et al., 2012). In an attempt to measure both recognition and recall, the HCTA is a standardized instrument that consists of 25 scenarios based on everyday situations that respondents analyze and evaluate (Butler et al., 2012; Verburgh et al., 2013). The first part of the HCTA directs respondents to answer open-ended questions, measuring recall memory; the second part of the HCTA requires respondents to answer force choice questions, which measures recognition memory (Butler et al., 2012; Verburgh et al., 2013). The HCTA provides an overall score, a constructed-response items (recall) score, a forced-choice items (recognition) score, as well as five subscale scores in each category resulting in 13 different scores (Butler et al., 2012, Verburgh et al., 2013).

Few instruments exist to explicitly measure critical thinking habits of mind. In this study, the California Critical Thinking Disposition Inventory will measure Army officers' habits of mind to think critically, and the California Critical Thinking Skills Test to measure overall strength in using reasoning to form reflective judgement about what to believe or what to do (Facione, 1990). This knowledge is essential for developing critical-thinking focused education strategies for future Army leaders.

### Summary

The Army faces a complex operating environment characterized by adaptive enemies, adversaries that are becoming increasingly technologically capable due to the ease of transference of modern technology, which minimizes U.S. technological advantage. The Army also faces shrinking budgets and force size reductions. Regardless of these challenges, the Army must meet the requirement to answer the Nations call to prevent conflict, shape the security environment, and win wars (DA, 2014a). In an effort to develop its workforce through the institutional domain to meet these goals, the Army will orient on outcome-based training and education (DA, 2011). Through well-trained and educated soldiers and cohesive teams, combined with technology, the Army gains competitive advantage in the future (McMaster, 2015). The Army workforce must be more adaptive and innovative than the adversaries of the U.S. One of the principle methods for the Army to develop its workforce is through the human dimension strategy, which maximizes individual and team performance through human performance optimization. This human performance optimization contains a cognitive attribute, which is the focus of the current study. Army literature states that critical thinking is one of the

most important competencies of its leaders (Allen & Gerras, 2009; DA, 2011, 2014c; Gerras, 2008; Straus et al., 2013; Thomas & Gentzler, 2013).

The Army acknowledges that its future operating environment will be complex, and its future budget will be fiscally constrained. If the Army's future operating environment is complex, and its foreseeable budget is constrained, then the Army should consider those skills that transcend all potential Army operations as a central focus of Army leader development practices. Army leaders must apply critical thinking skills in order to understand problems, develop creative solutions to problems, make effective decisions, and develop good situation awareness (Fischer et al., 2008). The leaders who are able to think critically are more effective at developing complex solutions to complex problems (Flores et al., 2012). Cognitively competent Army leaders understand the strategic picture, and comprehend facets of a problem as well as differentiate the insignificant from the significant (Myers, 2008). Critical thinking is an essential competency that Army leaders will require regardless of where they are or what they are doing (Williams, 2013).

One of the most important outcomes of higher education is the development of critical thinking skill (Abrami et al., 2008; Behar-Hohenstein & Niu, 2011; Duron et al., 2006; Facione, 1990; Halpern, 1999; Liu et al., 2014; Nusche, 2008; Paul & Elder, 2001; Pellegrino & Hilton, 2012; Tiruneh et al., 2014). The Army knows that the majority of its workforce does not possess a college degree, which creates a potential gap in cognitive capability. Developing critical thinking-focused military education strategies to achieve optimized workforce performance is problematic for the Army because the Army performs little to no evaluation to determine that critical thinking, as a learning outcome,

has been achieved through any level of education. By measuring the critical thinking talent of two groups of junior Army officers with different levels of education, and exploring differences between the groups, the Army can better understand the level of critical thinking talent across the workforce. Once the Army has a deeper understanding of the level of critical thinking talent across its workforce, and to what degree education effects critical thinking talent, it can then develop critical thinking-focused curricula that could assist in achieving the outcomes of its human dimension concept.

## CHAPTER III

### RESEARCH DESIGN AND METHODOLOGY

The complexity of the Army's future operating environment requires its leaders to possess high-level cognitive skills, manifested in critical thinking and problems solving (Allen & Gerras, 2009; DA, 2011; Fischer et al., 2008, 2009). The complexities from the future operating environment stem from the assumptions of the future is unknowable and constantly changing (DA, 2014a), and much of war's uncertainty stems from its human element (McMaster, 2015). A review of literature revealed abundant research indicating critical thinking as one of the most important outcomes of higher education (Abrami et al., 2008; Behar-Hohenstein & Niu, 2011; Duron et al., 2006; Facione, 1990; Halpern, 1999; Liu et al., 2014; Nusche, 2008; Paul & Elder, 2001; Pellegrino & Hilton, 2012; Tiruneh et al., 2014). Industrial-Organizational psychology literature indicates that many college graduates do not possess the critical thinking skills expected of a college graduate (Laird et al., 2014; Liu et al., 2014). Army leaders have also identified that Army education institutions are not developing the cognitive skills necessary for critical thinking and problem solving (Hatfield et al., 2011), which creates a potential capability gap for the Army. This gap in capability comes from the Army wanting its workforce to be talented critical thinkers, education literature indicating college education develops critical thinking (Dietz & Schroeder, 2012; Halpern, 1999; Tiruneh et al., 2014) but 78% of the Army's workforce does not possess a 4-year college degree (DoD, 2013). This study addresses these gaps by measuring the level of critical thinking disposition and skill of two groups of junior Army officers with different levels of education, and examining differences between groups. While extensive research exists on the importance of critical

thinking disposition and skill in the healthcare and education fields, sparse research is available on critical thinking talent in military and leadership literature. This chapter provides a framework for the methodology of the study. Included in this chapter are the research objectives, population and sample, research design, data collection procedure, instrumentation, data analysis, and summary.

### Research Objectives

Based on the review of relevant literature, the researcher developed six research objectives. The objectives of this study focus on the assessment of critical thinking talent of Army officers through the CCTDI and CCTST. The primary research question is what are the levels of critical thinking disposition and skill of junior Army officers?

Additionally, in support of the primary research question, this study address the following research objectives:

RO1: Describe the demographic characteristics of the sample in terms of level of education, age, and years of service.

RO2: Determine junior Army officers' perceived level of critical thinking disposition as measured by seven attributes that influence an individual's capacity to learn and apply critical thinking skills.

RO3: Determine junior Army officers' perceived level of critical thinking skills as measured by seven core-reasoning skills needed for reflective decision-making.

RO4: Determine differences in perceived critical thinking disposition across participant level of education.

RO5: Determine differences in perceived critical thinking skill across participant level of education.

RO6: Examine the within-group relationship between CCTDI scores and subscale scores with CCTST scores and subscale scores.

Data for Research Objective 1 was collected through participants self-reporting their age, years of military service, and if they possessed a 4-year degree. Research Objective 2 determined the perceived level of critical thinking disposition of junior Army officers by measuring the attributes that influence ones' capacity to learn and their willingness to engage in critical thought through using the CCTDI (Insight Assessment, 2015a). This data include an overall CCTDI score, and seven subscale scores. Research Objective 3 determined the perceived level of critical thinking skill of junior Army officers by measuring the core reasoning skills needed for purposeful, self-regulatory judgment about what to believe or do through using the CCTST (Insight Assessment, 2015b). This data include an overall CCTST score and seven subscale scores. Research Objective 4 determined if differences in perceived critical thinking disposition between junior Army officers with a 4-year degree and junior Army officers without a 4-year degree. The study used descriptive and inferential statistics to describe and determine differences between groups in CCTDI overall score, as well as the seven subscale scores of *Truthseeking*, *Open-mindedness*, *Analyticity*, *Systematicity*, *Confidence*, *Inquisitiveness*, and *Maturity* (Insight Assessment, 2015a). Research Objective 5 determined differences in perceived critical thinking skill between junior Army officers with a 4-year degree and junior Army officers without a 4-year degree. Descriptive and inferential statistics were used to describe and determine differences between groups in overall CCTST scores as well as seven subscale scores of *Analysis*, *Evaluation*, *Inference*, *Inductive Reasoning*, *Deductive Reasoning*, *Interpretation*, and *Explanation*



(Insight Assessment, 2015b). Research Objective 6 determined the within-group relationship between critical thinking disposition and skill. The summary of research objectives as well as the plan for analyzing the data are listed in Table 2.

Table 2

*Summary of Research Objectives Data Analysis Plan*

Research Objective	Data Collected	Data Category	Data Analysis
RO1: Describe the demographic characteristics of the sample	Level of education, age, years of service	Nominal, Ordinal, and Interval	Descriptive Statistics ( $n, M, s$ )
RO2: Determine junior Army officers perceived level of critical thinking disposition	CCTDI total score and subscale scores	Ordinal, Interval	Descriptive Statistics ( $n, M, s, \text{min. and max. scores}$ )
RO3: Determine junior Army officers perceived level of critical thinking skill	CCTST total score and subscale scores	Interval	Descriptive Statistics ( $n, M, s, \text{min. and max. scores}$ )
RO4: Determine differences in perceived level of critical thinking disposition	CCTDI scores and subscale scores	Ordinal, Interval	Inferential statistics: MANOVA, Wilks's $\Lambda$ , p-value
RO5: Determine differences in perceived level of critical thinking skill	CCTST scores and subscale scores	Interval	Inferential statistics: MANOVA, Wilks's $\Lambda$ , p-value
RO6: Determine the within-group relationship between critical thinking disposition and skill	CCTDI and CCTST total scores and subscale scores	Ordinal, Interval	Inferential statistics: Pearson's product moment correlation $r$

### Research Design

Quantitative research often follows two methods of inquiry: experimental and non-experimental (Creswell, 2003). This study employs a non-experimental, cross-sectional, explanatory design to address the research objectives (Gilner, Morgan, & Leech, 2009; Shadish, Cook, & Campbell, 2002): A study is non-experimental when the

researcher does not manipulate the variables (Belli, 2009). There was no manipulation of the variables in the current research, as the independent variable, a 4-year college degree, is an attribute variable. Another characteristic of non-experimental design is the assignment of participants lacks randomness. This research utilized purposive, non-probability convenience sampling due to the fiscal, travel, and time constraint limitations of the study, as well as a concentrated number of the population under study are collocated with the researcher.

In accordance with the primary research objective, the current study utilized a non-experimental design to determine if differences exist between two groups by examining how an independent variable (4-year degree) relates to a series of dependent variables (CCTDI and CCTST total scores and sub-scale scores). The attribute independent variables were nominal and between subjects: one group (a) of junior Army officers classified as possessing a 4-year college degree, and another group (b) of junior Army officers classified as not possessing a 4-year college degree. The interval dependent variables in the current study were (a) CCTDI scores with seven subscale scores, and (b) CCTST scores with seven subscale scores.

#### Population and Sample

The population under study is junior Army officers. Sample participants ( $N = 100$ ) for this study were two sub-groups of junior Army officers: those with a 4-year college degree ( $n = 50$ ) and those with no 4-year college degree ( $n = 50$ ). To facilitate the identification of potential participants based on their level of education, one-half of the sample population in this study were Army lieutenants, all required to possess 4-year degrees from an accredited institution as a prerequisite for commissioning into the Army.

The other half of the population in this study were Army warrant officers in the rank of Warrant Officer 1 (WO1), none of whom are required to possess a 4-year degree for appointment into the Army. Although lieutenants and WO1s are different ranks, the Army categorizes both groups as junior Army officers (DA, 2014e). All participants were members of the same branch of the Army (aviation) where lieutenants and WO1s are most similar, as all members entering the branch are between the ages of 18 and 32, all passed an Army flying duty medical examination, and all scored a minimum of 40 on the Army Selection Instrument for Flight Training.

Since the literature reveals one of the fundamental outcomes of higher education is critical thinking (Abrami, et al., 2008; Behar-Hohenstein & Niu, 2011; Duron et al., 2006; Facione, 1990; Halpern, 1999; Liu et al., 2014; Nusche, 2008; Paul & Elder, 2001; Pellegrino & Hilton, 2012; Tiruneh et al., 2014), a 4-year college degree is the independent variable in this study that relates to critical thinking. Participants were placed into two groups based on their level of education, where one group all possessed a 4-year degree, and the other where none possessed a 4-year degree. This study is cross-sectional, as data collection occurred over a period of one week.

#### *Sampling Procedure*

The population under study is junior Army officers. The Army conducts junior Army officer training at numerous installations across the continental United States. The sample for this study consisted of junior Army officers of the same branch, where both lieutenants and warrant officers must (1) be between the ages of 18 and 32, (2) pass an Army flying duty medical examination, and (3) earn a minimum score of 40 on the Army Selection Instrument for Flight Training (DA, 2005). These specific requirements, not

required by other branches of the Army with warrant officers, result in the current study's sample of lieutenants and warrant officers being most demographically similar (DA, 2005) in terms of age and years of service.

Another factor governing selection of participants for this study was the number of junior Army officers enrolled in their respective basic officer courses (BOLC and WOBC). BOLC and WOBC are the branch-qualifying courses junior officers attend prior to reporting to their first assignment in the Army. As an example, junior officers assigned to the aviation branch of the Army learn to fly and function as aviation officers in the respective aviation BOLC and WOBC programs. The research location had a large enrollment of junior officers as potential sample participants.

Using purposive, nonrandom sampling, the study separated a sample population of junior Army officers into two groups: those with a 4-year degree, and those with no 4-year degree. The study location has the largest population in the Army of officers without a 4-year degree. Each group sample consisted of 50 participants, totaling 100 study participants. As is standard Army practice, potential participants for each group assemble each day for administrative accountability and announcements prior to beginning their day. After obtaining Graduate School Institutional Review Board approval (Appendix A) and validating exemption from military research requirements (Appendix B), the researcher coordinated with Army faculty to identify a day which was least obtrusive to student schedules and most conducive for data collection. Additionally, the researcher sent a memorandum to the military commander requesting permission to conduct the research with the two groups of officers in training that make up the sample.

The Commander of the students approved the request (as indicated by the Commander's initials on the memorandum) and this correspondence is in Appendix C.

The researcher was present at the student accountability formation for each group. At this time, faculty asked the formation of approximately 150 students if they would like to volunteer to participate in a research project requiring approximately one hour to complete two web-based surveys. Those who volunteered went into their regular classroom, where the researcher validated their selection criteria. Once the volunteer participants were in their classroom, the researcher verified the participant's level of collegiate education, to ensure they were in the correct group, and handed out participant informed consent forms (Appendix D).

#### *Confidentiality of Data*

Insight Assessment, the owner of the CCTDI and CCTST, provided each participant with a six-digit identification number after they logged in to the respective web-based instrument portal. The researcher created an account with Insight Assessment, protected through a login and password system. Access to the researcher database is, therefore, limited to the researcher only, and to technical staff at Insight Assessment who provide technical support to the researcher in the use of the online testing system. The participant informed consent form is located in Appendix D.

#### *Protection of Human Subjects*

This study received approval from The University of Southern Mississippi Institutional Review Board (Appendix A) for research on human subjects in accordance with established requirements. The current study was exempt from additional Army research approval requirements, as outlined in Appendix B. The researcher verified

informed consent by receiving the signed authorization forms from all participants (Appendix D). Participation in this study posed no known risks or hazards to the researcher or participants.

#### *Response Rate Considerations*

The researcher, prior to conducting the study, verbally requested both BOLC and WOBC faculty to ask respective BOLC and WOBC students if they would be willing to participate in a study that requires them to take two instruments, together taking approximately 70 minutes to complete sequentially. BOLC and WOBC faculty informed students the instruments include questions regarding awareness, expectations, and insights. Respective faculty informed BOLC and WOBC students there would be no remuneration, and participation is voluntary. The majority of students in both BOLC and WOBC indicated that would be willing to participate. Those students asked by BOLC and WOBC faculty if they would be willing to participate were not included in the current study. Based on the feedback from the BOLC and WOBC faculty, the researcher was confident that participants from each respective course would volunteer to meet the sample population goal of 50 junior officers possessing a 4-year college degree, and 50 junior officers not possessing a 4-year college degree to participate in this study. At the time of data collection, the number of volunteers exceeded the required number of participants.

#### Instrumentation

This non-experimental, cross-sectional, explanatory study utilized the CCTDI to determine the level of critical thinking disposition of junior Army officers by measuring the attributes that influence an individual's capacity to learn and to apply critical thinking

skills (Insight Assessment, 2015a). This study utilized the CCTST to determine the level of critical thinking skill of junior Army officers by measuring the core reasoning skills needed for reflective decision-making concerning what to believe or what to do (Insight Assessment, 2015a, 2015b). Participants were allotted 25 minutes to complete the CCTDI, and 45 minutes to complete the CCTST. The consensus definition of critical thinking described in the American Philosophical Association Delphi study (Facione, 1990) is the foundation for the CCTDI and CCTST instruments. Participants completed the CCTDI and CCTST through a secure web-based portal hosted by Insight Assessment, the owner of both instruments.

#### *California Critical Thinking Disposition Inventory*

This study utilized the CCTDI to measure participant's habits of mind to engage in critical thought (Insight Assessment, 2015a). The CCTDI invited respondents to indicate the degree to which they agreed or disagreed with statements expressing familiar opinions, beliefs, values, expectations and perceptions that relate to the reflective formation of reasoned judgments (Insight Assessment, 2015a). The Likert-type items used no technical vocabulary or critical thinking jargon (Insight Assessment, 2015a). The CCTDI was administered with a preset time limit of 30 minutes.

This instrument provided an overall score and seven subscale scores. The highest possible subscale score was 60. With seven subscale scores measured, the highest possible score on this instrument was 420. Participants saw 75 questions on a 6-point Likert-type scale. Participants only saw one item at a time on their computer screen, with a set of multiple-choice answers presented on the same screen. As the participants progressed through the instrument, they responded to each of the 75 items with the

degree to which they agreed or disagreed (Insight Assessment, 2015a). The instrument design is a forced choice model, not allowing for any neutral responses. Each item is either supportive of or in opposition to the seven attributes of critical thinking disposition (Insight Assessment, 2015a). The seven dispositional attributes are *Truthseeking*, *Analyticity*, *Open-mindedness*, *Systematicity*, *Confidence in Reasoning*, *Inquisitiveness*, and *Maturity in Judgement*, and are the measures identified in the APA Delphi study (Facione, 1990; Insight Assessment, 2015a).

The first attribute measured is *Truth seeking*, which is an individual's motivation to seek the best understanding of a given situation, regardless if it challenges his or her own beliefs (Insight Assessment, 2015a). *Analyticity* refers to the concept of one being alert to the outcomes of decision-making, and being able to anticipate their effects (Insight Assessment, 2015a). *Open-mindedness* is the ability to allow others to present a point of view that one does not agree with, and objectively consider their point (Insight Assessment, 2015a). *Systematicity* is the tendency to approach problems with an organized and focused method (Insight Assessment, 2015a). *Confidence in reasoning* refers to the habit of mind to engage in reflective thought as an approach to decision-making and problem solving (Insight Assessment, 2015a). *Inquisitiveness* refers to a person's intellectual curiosity, and their motivation to learn more when an answer is not immediately apparent (Insight Assessment, 2015a). *Maturity in judgement* is the tendency to make timely, sound decisions in the absence of perfect information, and able to make the best decision given multiple options (Insight Assessment, 2015a). Each of the seven CCTDI subscales was scored relative to a person's disposition to engage in critical thought, as described in Table 3.



Table 3

*CCTDI Subscale Score Descriptions*

Score	Description relative to the Subscale Score
50 - 60	Strong positive tendency toward critical thinking disposition
40 - 50	Positive tendency toward critical thinking disposition
30 - 40	Inconsistent / Ambivalent
20 - 29	Negative tendency toward critical thinking disposition
10 - 19	Strong negative tendency toward critical thinking disposition

Note. CCTDI overall score is the total of all seven subscale scores. Source: Insight Assessment, (2015a). *The California critical thinking disposition inventory: Measures and CCTDI scales*.

In addition to the subscale scores described in Table 3, the CCTDI provided an overall score (range = 70-420), and individuals with higher CCTDI scores were determined to have stronger dispositions to critical thinking (Insight Assessment, 2015a). However, the seven subscale scores provided more detail as to the specific areas of strength or weakness.

*California Critical Thinking Skills Test*

This study utilized the CCTST to measure participant's critical thinking skill. The CCTST is a standardized instrument designed for adults, based on the APA Delphi consensus study on critical thinking (Facione, 1990). Multiple-choice items use everyday scenarios, and each item required that the test-taker make an accurate and complete interpretation of the question (Insight Assessment, 2015b). The CCTST is "the product of research aimed at measuring high-stakes reasoning and decision-making processes" (Insight Assessment, 2015b, p. 11). The CCTST design engaged the test-taker's reasoning skills and consisted of 34 multiple-choice items designed to assess critical thinking skills, and scoring ranges from zero to 34 (Insight Assessment, 2015b).

Participants only saw one item at a time on their computer screen, with a set of multiple-choice answers presented on the same screen. As the participants progressed through the instrument, they responded to each of the 34 scenario-based items, with each item categorized into one of seven sub-scales: *Analysis*, *Interpretation*, *Inference*, *Evaluation*, *Explanation*, *Inductive Reasoning* and *Deductive Reasoning* (Insight Assessment, 2015b). The total score consisted of the number of correct responses out of the 34 items. The CCTST delivered an overall score and seven subscale scores (Insight Assessment, 2015b). Unlike the CCTDI, the subscale scores on the CCTST are not independent elements. Therefore, individual subscale scores are inappropriate for use to describe respondent critical thinking skill but are meaningful in this study to determine differences between groups.

The first subscale measured was *Analysis*, which is how people identify arguments, clarify meaning, and interpret significance. *Inference* skills allow one to “draw conclusions from reasons and evidence” (Insight Assessment, 2015b, para. 4). *Evaluation* is how one assesses arguments and their credibility, as well as stating opinions and justifying methods. *Interpretation* refers to the ability to determine the meaning of messages, signals, and diagrams. *Deduction* is “the assumed truth of the premises purportedly necessitates the truth of conclusion” (Insight Assessment, 2015b, para. 6). *Explanation* allows one to “discover, test, and articulate the reasons for beliefs”, as well as “enables one to make a final decision about what to believe or do” (Insight Assessment, 2015b, para. 9). Conclusions are certain if the premise is true. *Induction* means “an argument’s conclusion is purportedly warranted, but not necessitated by the assumed truth of its premises” (Insight Assessment, 2015b, para. 7). Descriptions of the

level of critical thinking skill as manifested through the seven CCTST subscale scores are listed in Table 4.

Table 4

*CCTST Subscale Score Descriptions*

Score	Description relative to the Subscale Score
86 – 100	Superior: Potential for advanced learning and leadership
79 – 85	Strong: Potential for academic success and career development
70 – 78	Moderate: Potential for skills-related challenges
63 – 69	Weak: Difficulty with reflective problem solving and decision-making
50 – 62	Not manifested: Possible insufficient test-taker effort or fatigue

Note. CCTST overall score is the total of all seven subscale scores. Source: Insight Assessment, (2015b). *California critical thinking skills test (CCTST)*.

*Instrument Validity and Reliability*

Just as researchers are concerned with the validity of the overall research design, so must they carefully utilize valid and reliable data collection methods. The researcher did not develop the instruments utilized in this study, but utilized commercially available instruments. The next sections discuss reliability and validity for the CCTDI and CCTST.

*Content Validity.* An important criterion for content validity refers to the ability of an instrument to represent a measure of the desired domain. The APA Delphi description of the ideal critical thinker is the foundation for the CCTDI and CCTST (Insight Assessment, 2015a; 2015b). Another criterion of content validity refers to the utilization of user-friendly methods of instrument development (Insight Assessment, 2015a; 2015b). The CCTDI and CCTST are attitudinal measures that use standardized methods, and their instrument prompts express familiar opinions and expectations, and use no technical jargon or specialized vocabulary (Insight Assessment, 2015a; 2015b).

*Construct Validity.* Construct validity refers to whether the instrument addresses the appropriate domain. The current study measured the critical thinking disposition and skill of junior Army officers, and construct validity refers to whether or not the CCTDI and CCTST actually measured critical thinking disposition and skill. According to Insight Assessment (2015a; 2015b), construct validity “is typically demonstrated by correlational studies where, for instance, CCTDI scores are correlated with other measures that purport to include the same idea or construct and not correlated with instruments that address different ideas or constructs.” (p. 46) Regarding the CCTST, “high correlations with standardized tests of college-level preparedness in higher-order reasoning have been demonstrated” such as GRE Total Score ( $r = .719, p < .001$ ; Insight Assessment, 2015b, para. 1). Since this study utilized the CCTDI and CCTST to measure critical thinking talent, it was essential to know that the instruments correlate with other measures that include the critical thinking construct and were not correlated with instruments that measure different constructs (Insight Assessment, 2015a).

*Criterion Validity.* An important consideration in validating an assessment, criterion validity refers to the performance of the study’s operationalization against some criterion (Trochim & Donnelly, 2008). Criterion validity refers to the ability of an instrument to predict some meaningful measure or behavior external to the instrument itself (Nunnally & Bernstein, 1994). In the context of the current study and human capital development, the CCTDI may predict a measure of how well an Army leader is prepared to assume a leadership role based on their disposition to engage in critical thought. Where content validity refers to the ability of an instrument to represent a

measure of the desired domain, criterion validity refers to the degree to which a variable predicts the value of another variable (Trochim & Donnelly, 2008).

*Face Validity.* Face validity refers to the response a person has when they read the items on a survey instrument or an assessment and take the items at face value (Trochim & Donnelly, 2008; Insight Assessment, 2015a, 2015b). The instruments used in the study derive from the APA Delphi consensus definition of critical thinking, and the CCTDI and CCTST address the construct of critical thinking as presented to participants (Insight Assessment, 2015a, 2015b). Items on the CCTDI and CCTST used no technical vocabulary or jargon. Since the CCTDI and CCTST measured personality attributes, a risk existed that participants would not answer truthfully, as they may have desired to shape their perception positively. This phenomenon is social desirability response bias. The CCTDI and CCTST designs mitigated the threat of social desirability response bias, as measured by the Marlowe-Crowne Social Desirability Scale. The CCTDI and CCTST showed no significant relationships between CCTDI and CCTST scores and subscale scores on the Marlowe-Crowne (Insight Assessment, 2015a; 2015b).

### *Reliability*

Internal consistency (reliability) coefficients enable researchers to interpret the results of studies. Reliability is a not characteristic of a test, but is a characteristic of scores (Spearman, 1904). When researchers develop instrument items scored on a six-point continuum to form a scale, such as those found in the CCTDI, the items should be internally consistent (Insight Assessment, 2015a). Since dispositional or skill items purportedly measure the same construct respectively, they should be correlated. When

the correlation between items increases, it is expected that the reliability statistic will also increase (Streiner & Norman, 1989).

#### Data Collection Procedure

This study collected data with one interaction with each group of participants. Participants were identified as members of one of two groups: those with a 4-year degree, and those with no 4-year degree. Once participant education level was verified, and consent was obtained as outlined in Appendix D, participants were seated in their normal classroom with access to their laptop computers and Army-network internet access. The researcher asked the students to use their classroom computers access the Insight Assessment website, where participants were given a user name and password to log into the web-based instrument interface. Each group had its own unique login and password, which was used to organize data between groups. Once the students accessed the website, they selected the "Test Taker Login" button at the top right hand of their screen. From this point, participants completed the login with the group-unique user name and password provided by the researcher. Although the researcher collected the participant - informed consent forms, no method of identifying participant identity associated with any collected data, as the demographic question design avoided asking personally identifiable information from study participants.

Participants provided the demographic information of age, years of military service, and whether or not they possessed a 4-year college degree. Study participants first completed the California Critical Thinking Disposition Inventory (CCTDI). Upon completion of the CCTDI, participants then completed the California Critical Thinking Skills Test (CCTST). Sample CCTDI and CCTST questions, provided by Insight

Assessment, are in Appendices E and F. Participants had the ability to opt-out or decline at any time in the process. Upon completion of both the CCTDI and CCTST, participants departed to resume their normal schedule.

### Threats to Study Validity

Social science research often involves observation and measurement. As such, validity of research refers to the quality of the elements of a research method that led to a conclusion (Trochim & Donnelly, 2008). During the research planning and design process, the researcher consciously addressed threats to validity, and the next sections discuss methods used to mitigate threats to study validity.

#### *Conclusion Validity*

Conclusion validity, often referenced as statistical conclusion validity, refers to determining if a relationship between two variables in a study, and the degree to which conclusions reached about data, is reasonable (Trochim & Donnelly, 2008). When investigating relationships, it is important to consider all possibilities of whether or not a relationship actually exists or does not exist. Conclusion validity differs from internal validity in that conclusion validity only refers to whether or not a relationship exists and is reasonable, not whether or not a treatment may have caused an outcome (internal validity). It is possible for a study to have conclusion validity and not internal validity (Trochim & Donnelly, 2008). To improve study conclusion validity, which precludes the current study from inaccurately concluding that relationships exist (or do not exist) between independent and dependent variables, appropriate statistical tests were selected, and their underlying assumptions tested, prior to their use (García-Pérez, 2012; Shadish, Cook, & Campbell, 2002).

### *Internal Validity*

Shadish et al. (2002) purport that internal validity describes whether one can make causal inference about results. If a research finding or conclusion claims that a treatment or program caused the outcome(s) in the study, one considers the internal validity of the causal claim (Trochim & Donnelly, 2008). To preserve internal validity, researchers should demonstrate changes to the dependent variable(s) result from independent variable(s). As such regarding the current study, CCTDI and CCTST scores are the dependent variables, and a 4-year college degree is the independent variable. A threat to internal validity in the current study was design contamination, where junior Army officers in a BOLC or WOBC class could possibly have discussed the study with other classes. Low likelihood of design contamination existed due to the research design, where the minimal level of interaction between different BOLC and WOBC classes. As students graduate from the BOLC and WOBC, they move on to their much-anticipated branch-qualifying course, conducted in separate facilities and classrooms.

### *Construct Validity*

In simple terms, construct validity relates to generalizing, where the degree to which inferences can be made from the results of a study relate to the theoretical construct upon which the study was based (Trochim & Donnelly, 2008). Construct validity refers to the degree which sample constructs can generalize to higher order constructs. The current study used the 1990 APA Delphi consensus definition of critical thinking and its core cognitive skills as the study's critical thinking construct. The APA Delphi report consensus characterization of the ideal critical thinker is the foundation for both the CCTDI and CCTST (Facione, 1990) and is the reason for their selection.



### *External Validity*

Contrasting with internal validity, external validity refers to the degree to which results of a study are generalizable to other people, groups, or situations (Rocco & Hatcher, 2011; Shadish et al., 2002). Researchers should examine the external validity of claims and findings in their research, and should examine whether they have implications for other groups and individuals in other research settings (Trochim & Donnelly, 2008). The current study determined if junior Army officers with a 4-year college degree had different critical thinking scores as measured on the CCTDI and CCTST compared to junior Army officers with no 4-year degree. Threats to external validity include the interaction of the selection, setting, and history with the treatment (Cook & Campbell, 1979). The population under study is junior Army officers. However, all junior Army officer participants in this study were members of a single branch of the Army, and the Army has several different branches, such as Infantry, Armor, Field Artillery, Aviation, and Special Forces. Threats to external validity are generally applicable to generalizations made across populations, rather than generalizations made to specific populations being researched (Cook & Campbell, 1979).

### *Data Analysis*

Descriptive and inferential statistics were calculated for the variables in the study. Descriptive statistics provided a powerful summary that facilitated comparisons across groups (Trochim & Donnelly, 2008). Since the current study sought to determine if differences in the means of two groups were significant while controlling the covariates of age and years of service, the researcher originally selected multivariate analysis of covariance (MANCOVA) for statistical testing. MANCOVA must meet the same

assumptions of multivariate analysis of variance (MANOVA) which are normality, homogeneity of variance, and random and independent samples. In addition to meeting the assumptions of MANOVA, MANCOVA also assumes the relationship between the covariates (age and years of service) and the dependent variables (CCTDI and CCTST scores) are linear, that the linearity is parallel, and that the covariates are independent of the independent variable (4-year degree). As shown in Chapter IV, neither covariate (participant age nor years of service) has a significant linear relationship with the dependent variables, thus MANCOVA is not the appropriate statistical test for the current study (Hoekstra, Kiers, & Johnson, 2012). As such, the researcher utilized MANOVA as the statistical test to determine differences in means between groups.

To analyze Research Objective 1, during the demographic portion of the CCTDI and CCTST participants self-reported their age, years of service, and whether or not they have a 4-year degree. In order to describe the perceived critical thinking dispositions of each group as identified in Research Objective 2, descriptive statistics were used to describe the mean, standard deviation, and standard error of CCTDI total score between groups, using a 95% confidence interval for means. Mean, standard deviation, and minimum and maximum scores were calculated for the seven CCTDI subscale scores.

In order to describe the perceived critical thinking skill of each group as identified in Research Objective 3, descriptive statistics were used to describe the mean, standard deviation, and standard error of CCTST total score between groups, using a 95% confidence interval for means. Mean, standard deviation, and minimum and maximum scores were calculated for the seven CCTST subscale scores.

In order to determine if differences in perceived level of critical thinking disposition existed as identified in Research Objective 4, a MANOVA was conducted between junior Army officers with a 4-year degree and junior Army officers with no 4-year degree as well as follow up ANOVAs on CCTDI subscale scores. In order to determine if differences in perceived level of critical thinking skill existed as identified in Research Objective 5, a MANOVA was conducted between junior Army officers with a 4-year degree and junior Army officers with no 4-year degree, along with follow-up ANOVAs on the CCTST subscale scores.

In addition, in order to examine the degree of linear dependence of the within-group variables of critical thinking disposition and skill as identified in Research Objective 6, the researcher used Pearson's product moment coefficient, designated by  $r$ . Pearson's was an appropriate test of correlation when both variables (CCTDI and CCTST scores) are interval data, using the assumptions that variance and linearity are constant (Trochim & Donnelly, 2008).

### Summary

This non-experimental, cross-sectional, explanatory study accomplished the study's six research objectives by determining the perceived level of critical thinking talent of two groups of junior Army officers, and by determining if differences exist between groups relative to the independent variable of a 4-year college degree. The researcher used purposive, convenience sampling based on the concentration of potential participants at the study's location. After obtaining appropriate IRB and Army command approval, the researcher administered the CCTDI and CCTST to two groups of 50 volunteer junior Army officer participants, as described in the research objectives. The

researcher utilized Statistical Package for the Social Sciences (SPSS) software version 21.0 to analyze CCTDI and CCTST data, and determined if differences in scores and subscale scores exist between junior Army officers with a 4-year degree and junior Army officers without a 4-year degree. In addition, statistical analysis was conducted to determine the within-group relationship between critical thinking disposition and critical thinking skill.

## CHAPTER IV

### RESULTS

The purpose of this study was to measure perceived levels of critical thinking talent of two groups of junior Army officers with different levels of education, and determine if differences exist between the two groups. An additional study goal included examining the relationship between critical thinking disposition and skill within each group. This chapter provides a review of the results from the quantitative analysis of data collected from the two groups of junior Army officers.

This research provides essential understanding into the perceived level of critical thinking talent of junior Army officers across level of education. Using two instruments to measure perceived critical thinking disposition and skill, the data presents an insightful picture of the relationship of a 4-year degree to junior Army officer level of critical thinking talent. Education literature shows that higher education is one of the primary methods of developing critical thinkers (Abrami, et al., 2008; Behar-Hohenstein & Niu, 2011; Duron et al., 2006; Facione, 1990; Halpern, 1999; Liu et al., 2014; Nusche, 2008; Paul & Elder, 2001; Pellegrino & Hilton, 2012; Tiruneh et al., 2014). However, industrial-organizational psychology literature indicates that many college graduates are not meeting the critical thinking outcomes expected of the workforce (Carmel & Yezierski, 2013; Flores et al., 2012; Ritchie et al., 2015). This tension identified a gap in the literature resulting from the conflicting research on the efficacy of college education on level of perceived critical thinking talent in the workforce. Therefore, this study adds to the body of knowledge of organizational development and critical thinking in the Army (Allen & Gerras, 2009; Cojocar, 2011; Colarusso & Lyle, 2014; Dietz &

Schroeder, 2012; Fischer et al., 2008, 2009; Gerras, 2008; McMaster, 2015; Schumm et al., 2010; Straus et al., 2014; Thomas & Gentzler, 2013; Wardynski et al., 2009)

### Data Results

This study design determined if critical thinking assessment scores for junior Army officers with a 4-year degree were different from the critical thinking assessment scores of junior Army officers with no 4-year degree, with both groups using the same assessment instruments. This study also investigated the within-group relationship between critical thinking disposition and critical thinking skill. The data collected for this study were collected electronically, and later analyzed using Statistical Package for the Social Sciences (SPSS) software version 21.0. The CCTDI measured participant disposition to engage in critical thought and form judgements about what to believe or do (Insight Assessment, 2015a). The CCTDI has seven subscales that measure the aspects of the participants' overall disposition to think critically: *Truthseeking*, *Open-mindedness*, *Analyticity*, *Systematicity*, *Confidence in Reasoning*, *Inquisitiveness*, and *Maturity of Judgment* (Insight Assessment, 2015a). The CCTST was used to measure participant's core reasoning skill needed for making the decision of what to believe or what to do (Insight Assessment, 2015b). The CCTST has seven subscales which measure participant ability to engage in critical thought: *Analysis*, *Inference*, *Evaluation*, *Deduction*, *Induction*, *Interpretation*, and *Explanation* (Insight Assessment, 2015b).

*Internal Consistency*

To measure internal reliability and consistency of the data, Cronbach's alpha was calculated for the CCTDI total score and subscale scores. Cronbach's alpha is suitable for Likert-type items producing ordinal data such as those found in the CCTDI

(Gadermann, Guhn, & Zumbo, 2012). CCTDI data have good internal consistency for the current study,  $\alpha = .783$  (Streiner, 2003), which is slightly lower than the Insight Assessment report for CCTDI reliability as ranging between .80-.98 (Insight Assessment, 2015a). The internal consistency statistic for dichotomously scored items such as those found on the CCTST is the Kuder-Richardson Formula 20 (KR-20) coefficient (Thompson, 2003). In the current study, CCTST total score and subscale score reliability coefficient calculated by KR-20 was .94, which is indicative of a homogenous instrument (Christmann & Badgett, 2009). Insight Assessment reports the KR-20 reliability statistic for the CCTST total score range between .77-.83 (Insight Assessment, 2015b).

#### *Statistical Test Assumptions*

Violations of underlying statistical test assumptions can have negative effects on Type I and Type II error, and can result in inaccurate inferences and effect sizes in statistical testing (Hoekstra et al., 2012). The researcher posited that age and years of military service may confound the statistical analysis between groups. As such, the research design for this study called for collecting the demographic data of participant age and years of military service for use as covariates in a multivariate analysis of covariance (MANCOVA). A MANCOVA has advantages over MANOVA in that MANCOVA statistically controls bias that may come from a confounding variable, or covariate, which may negatively affect the results of the test (Salkind & Rasmussen, 2007). One of the assumptions of MANCOVA is that covariates (age and years of service) are linearly related to dependent variables (CCTDI and CCTST scores) at each level of the independent variable (4-year degree or no 4-year degree; Salkind & Rasmussen, 2007). Researchers should check and be prepared to discuss underlying

assumptions of statistical tests in published research (Hoekstra et al., 2012), and therefore covariate and dependent variable collinearity for CCTDI and CCTST are shown in Table 5.

Table 5

*Assumption of MANCOVA – CV to DV Correlation*

Measure		Age	Years of Service
CCTDI Total	<i>r</i>	.166	.070
	<i>p</i>	.098	.490
Truthseeking	<i>r</i>	.102	.011
	<i>p</i>	.313	.916
Open-Mindedness	<i>r</i>	.090	-.116
	<i>p</i>	.374	.249
Inquisitiveness	<i>r</i>	.117	.088
	<i>p</i>	.246	.384
Analyticity	<i>r</i>	.111	.001
	<i>p</i>	.271	.989
Systematicity	<i>r</i>	.103	.048
	<i>p</i>	.307	.634
Confidence in Reasoning	<i>r</i>	.229*	.152
	<i>p</i>	.022	.132
Maturity of Judgement	<i>r</i>	.276*	.153
	<i>p</i>	.005	.129
CCTST Total	<i>r</i>	-.053	-.103
	<i>p</i>	.600	.307
Analysis	<i>r</i>	-.064	-.089
	<i>p</i>	.525	.379
Interpretation	<i>r</i>	-.087	-.107
	<i>p</i>	.390	.288
Inference	<i>r</i>	-.185	-.195
	<i>p</i>	.065	.052
Evaluation	<i>r</i>	.083	.016
	<i>p</i>	.410	.876
Explanation	<i>r</i>	.087	.035
	<i>p</i>	.388	.730
Induction	<i>r</i>	-.033	-.084
	<i>p</i>	.742	.405
Deduction	<i>r</i>	-.071	-.105
	<i>p</i>	.482	.300

Note. *r* = Pearson's product-moment correlation coefficient; *p* = level of significance ( $p < .05$ ); ( $N = 100$ )



The data in Table 5 indicate that the covariate of age is significantly correlated with only two of seven CCTDI subscale scores: Confidence in Reasoning and Maturity. CCTDI total score and remaining five CCTDI subscale scores are not significantly correlated to either covariate of participant age or years of service. CCTST total score and all seven subscale scores are not significantly correlated to either of the covariates with  $\alpha = .05$ . Since only 2 of 14 combined CCTDI and CCTST subscale score dependent variables have a significant linear relationship with the covariate age, and no significant linear relationship with the covariate years of service, a MANCOVA is not an appropriate statistical test (Hoekstra et al., 2012), thus MANOVA was used to determine differences between groups.

Tests to measure skewness and kurtosis for assessing normality, along with omnibus tests such as Shapiro-Wilk, are recommended for univariate normality assumption testing (DeCarlo, 1997). To confirm that both CCTDI and CCTST scores for both groups were normally distributed, a Shapiro-Wilk's test of normality was conducted on CCTDI total and subscale scores (Table 6) and CCTST total and subscale scores (Table 7). Since skewness and kurtosis are related to sample size (Cox, 2010; DeCarlo, 1997), these data are included in Tables 6 and 7.

Shapiro-Wilk is the best omnibus test of normality up to  $n = 50$  (Rahman & Govindarajulu, 1997), based on the null hypothesis that the population distribution is normal. A weakness of the Shapiro-Wilk  $W$  test is that sample sizes larger than  $n = 50$  limit its applicability (Rahman & Govindarajulu, 1997), a consideration which the researcher has mitigated through a research design with two equal groups of 50

participants. The Shapiro-Wilk  $W$  values in Tables 6 and 7 are the  $p$ -values for the tests, where any result less than  $\alpha = .05$  would indicate a non-normal distribution.

Table 6

*Tests of Normality for CCTDI Total and Subscale Scores*

Measure	4-Year Degree Group			No 4-Year Degree Group		
	Skewness	Kurtosis	Shapiro-Wilk	Skewness	Kurtosis	Shapiro-Wilk
CCTDI Total	.232	-.201	.477	-.002	.280	.921
Truthseeking	-.361	.138	.431	.440	-.182	.264
Open-Mindedness	-.699	.299	.066	-.358	-.524	.136
Inquisitiveness	-.500	-.017	.297	-.529	-.141	.168
Analyticity	.025	.625	.641	-.182	-.307	.517
Systematicity	-.067	-.451	.709	.388	.138	.268
Confidence in Reasoning	-.081	-.372	.276	-.541	.425	.167
Maturity of Judgement	-.094	-.254	.854	-.631	.534	.101

Note. Standard Error (S.E.) for Skewness remained constant at .337; S.E. for Kurtosis remained constant at .662;

CCTDI total scores and subscale scores for both the 4-Year degree group and No 4-Year degree group are normally distributed, with no statistically significant Shapiro-Wilk values (Table 6).

Table 7

*Tests of Normality for CCTST Total and Subscale Scores*

Measure	4-Year Degree Group			No 4-Year Degree Group		
	Skewness	Kurtosis	Shapiro-Wilk	Skewness	Kurtosis	Shapiro-Wilk
CCTST Total	-.101	-.074	.797	.102	-.686	.573

Table 7 (continued).

Measure	4-Year Degree Group			No 4-Year Degree Group		
	Skewness	Kurtosis	Shapiro-Wilk	Skewness	Kurtosis	Shapiro-Wilk
Analysis	-.159	.771	.069	-.141	-.645	.045*
Interpretation	-.479	-.158	.007*	-.077	-.696	.006*
Inference	-.066	-.161	.368	.238	-.590	.147
Evaluation	.180	-.785	.088	-.026	-.963	.126
Explanation	.167	-.607	.039*	.571	-.125	.006*
Induction	-.228	-.283	.204	.062	-.667	.471
Deduction	-.094	-.254	.854	-.631	.534	.515

Note. Standard Error (S.E.) for Skewness remained constant at .337; S.E. for Kurtosis remained constant at .662;

\* = Significant at  $p < .05$

The results in Table 7 show that within the 4-Year degree group, assumptions of normality were violated for the CCTST subscales of Interpretation ( $p = .007$ ) and Explanation ( $p = .039$ ). Within the No 4-Year degree group, assumptions of normality were violated for the CCTST subscales of Analysis ( $p = .045$ ), Interpretation ( $p = .006$ ), and Explanation ( $p = .006$ ). Although assumptions for normality are violated in the above named subscales, excess skewness and excess kurtosis is considered moderate, as all values are within the range of -1 to 1, and are therefore acceptable to indicate a normal distribution (George & Mallery, 2011).

Essential to understanding the importance of variance between groups is acknowledging that Levene's test for homogeneity of variance actually refers to a family

of tests, from which analysis of groups focus on either group means or group medians (Nordstokke & Zumbo, 2007). To determine that the error variance of CCTDI and CCTST subscale scores is equal across groups, Levene's test for equality of variances was performed on CCTDI and CCTST subscale scores, as outlined in Table 8.

Table 8

*CCTDI and CCTST Homogeneity of Variance*

Subscale Score Measure	<i>F</i>	Sig
CCTDI Subscale		
Truthseeking	3.027	.085
Open-Mindedness	.391	.533
Inquisitiveness	.810	.370
Analyticity	.355	.553
Systematicity	4.957	.028*
Confidence in Reasoning	.463	.498
Maturity of Judgement	.537	.465
CCTST Subscale		
Analysis	.877	.351
Interpretation	.619	.433
Inference	.005	.946
Evaluation	.246	.621
Explanation	.000	.997
Induction	.395	.531
Deduction	1.019	.315

Note. Significant at  $p < .05$

Homogeneity of variance was violated for the CCTDI subscale of Systematicity ( $p = .028$ ), with all other CCTDI subscales not statistically significant. Since the results of Levene's test of homogeneity of variance was violated for the CCTDI subscale of Systematicity ( $p = .028$ ), the Brown-Forsythe test was applied to Systematicity, and found not significant ( $p = .160$ ). Brown-Forsythe is applied when variances are not homogeneous (Brown & Forsythe, 1974), as it calculates the deviation from group *medians* as opposed to Levene's calculating deviation from group *means* (Olejnik &

Algina, 1987). None of CCTST subscales were statistically significant, and the assumption of homogeneity of variance for CCTST subscale scores between groups was met.

CCTDI subscale scores were normally distributed in both groups. The distribution of CCTST subscale scores were not normal in either group. However, CCTST subscale excess kurtosis and excess skewness values for both groups were between -1 and 1 for all non-normal distributions, which is considered moderate (Thulin, 2014). MANOVA is a robust test when sample sizes are equal (Thulin, 2014). Based on assumptions testing, MANOVA will be used to compare CCTDI and CCTST scores between junior Army officers with 4-Year degrees and junior Army officers with no 4-Year degrees. Significance levels were set a priori  $\alpha = .05$ .

#### *Research Objective 1*

This study took place on a large military base in the Southeast, which provided unique access to a large population of junior Army officers ( $N > 1,000$ ). To address Research Objective One, demographic information, including participant age and years of military service were collected from both groups of junior Army officers ( $N = 100$ ) as they prepared to take the CCTDI and CCTST. The researcher collected this data to better describe the sample and provide necessary covariate data. Participants ( $N = 100$ ) self-reported the demographic data of their age and years of service, and self-reported whether or not they had a 4-year degree. Providing descriptive characteristics of a sample gives the reader an idea of the scope of the study, as well as revealing potential data patterns, giving more meaning to the results (Emerson, 2015). Participant demographic information is displayed in Table 9.

Table 9

*Participant Demographics*

Group	<i>n</i>	<i>M</i>	<i>s</i>
4-year degree	50		
Age		24.20	2.22
Years of service		2.16	2.08
No 4-year degree	50		
Age		27.70	3.68
Years of service		7.58	3.48

All junior Army officers in this study were members of the same branch of the Army, which limits the maximum age for entry to 32 years old. An independent samples *t*-test was conducted to compare the differences in age and years of service between the two groups of junior Army officers. Junior Army officers with a 4-year degree were significantly younger than junior Army officers with no 4-year degree  $t(98) = 5.75, p < .001$ . Junior Army officers with a 4-year degree had significantly fewer years of military service than junior Army officers with no 4-year degree  $t(98) = 9.45, p < .001$ .

The statistically significant differences in age and years of service are consistent with the source of accession of the two groups. As the members of the No 4-year degree group were warrant officers, the data is consistent with the No 4-year degree group being older and possessing more years of service than the lieutenants in the 4-year degree group, as 90% of warrant officers are accessed from personnel already in the military (DA, 2006). The researcher posited that differences in age and years of service between the two groups of junior Army officers could be statistically significant, therefore incorporated these data into the original research design as covariates for statistical analysis through MANCOVA, where the statistical test would have controlled for the effects of age and years of service. However, in this study the covariate of participant

age was significantly correlated to only two of seven CCTDI subscale scores: Confidence in Reasoning and Maturity. The relationship between the covariate years of service and the remaining CCTDI subscales as well as all seven CCTST subscales (Table 5) were not significant, which means that as participant age and years of service went up or down, there was no corresponding increase or decrease of respective CCTDI or CCTST scores.

### *Research Objective 2*

Higher CCTDI subscale scores are indicative of one who has a strong desire to apply their critical thinking skill in decision-making and problem solving (Giancarlo & Facione, 2001). In order to describe perceived critical thinking dispositions of the 4-year degree group and the No 4-year degree group, as identified in Research Objective 2, descriptive statistics describe the mean, standard deviation, and standard error of CCTDI total scores of both groups, using a 95% confidence interval for means (Table 10). Mean, standard deviation, and minimum and maximum scores calculated for the seven CCTDI subscale scores are listed in Table 11.

Table 10

### *Descriptive Statistics of CCTDI Total Scores*

Group	<i>n</i>	<i>M</i>	<i>s</i>	SE	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
4-year degree	50	323.12	31.48	4.45	314.17	332.07	248	393
No 4-year degree	50	331.14	26.39	3.73	323.64	338.64	272	400
Total	100	327.13	29.18	2.91	321.34	332.92	248	400

Data in Table 10 reveal that the mean CCTDI total score of the of the 4 year degree group ( $n = 50$ ,  $M = 323.12$ ) was within 8 points (2% difference) of the CCTDI total score mean of the No 4-year degree group ( $n = 50$ ,  $M = 331.14$ ).

Table 11

*Descriptive Statistics of CCTDI Subscale Scores*

CCTDI	<i>M</i>	<i>s</i>	Min Score	Max Score
4-Year Degree ( $n = 50$ )				
Total Score	323.12	34.48	248	393
Truthseeking	41.38	6.86	22	53
Open-Mindedness	44.16	5.71	29	54
Analyticity	48.92	4.95	35	60
Systematicity	46.32	6.57	32	60
Confidence	48.46	6.11	36	60
Inquisitiveness	50.28	5.88	34	60
Maturity	43.72	6.17	29	56
No 4-Year Degree ( $n = 50$ )				
Total Score	331.14	26.39	272	400
Truthseeking	42.80	5.20	33	56
Open-Mindedness	43.86	5.03	33	53
Analyticity	49.14	4.31	40	59
Systematicity	47.96	4.86	38	60
Confidence	50.24	5.44	34	60
Inquisitiveness	51.36	5.30	38	60
Maturity	45.92	5.48	31	58

The lowest mean CCTDI subscale score for both groups was found in Truthseeking (4-year degree group [ $M = 41.38$ ,  $s = 6.86$ ], No 4-year degree group [ $M = 42.80$ ,  $s = 5.20$ ]). Truth seeking is the habit of seeking the best possible understanding of a given situation, where one follows reason and evidence even if the evidence challenges their own beliefs (Insight Assessment, 2015a). The highest mean CCTDI subscale score for both groups was found in Inquisitiveness (4-year degree group [ $M = 50.28$ ,  $s = 5.88$ ], No 4-year degree group [ $M = 51.36$ ,  $s = 5.48$ ]). Inquisitiveness is intellectual curiosity and the inclination to want to know things, even if they are not instantly or observably



useful (Insight Assessment, 2015a). The mean CCTDI subscale scores for both the 4-year degree group and the No 4-year degree group were above 40 on all seven of the CCTDI subscales, indicating a positive tendency toward critical thinking disposition (Facione, 2015; Insight Assessment, 2015a).

### *Research Objective 3*

In order to describe perceived critical thinking skill of the 4-year degree group and the No 4-year degree group as identified in Research Objective 3, descriptive statistics described the mean, standard deviation, and standard error of CCTST total scores of both groups, using a 95% confidence interval for means (Table 12). Mean, standard deviation, and minimum and maximum scores were calculated for the seven CCTST subscale scores in Table 13.

Table 12

### *Descriptive Statistics of CCTST Total Scores*

Group	<i>n</i>	<i>M</i>	<i>s</i>	SE	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
4-year degree	50	78.02	7.85	1.11	75.79	80.25	61	97
No 4-year degree	50	77.26	7.65	1.08	75.08	79.44	62	93
Total	100	77.64	7.72	.77	76.11	79.17	61	97

Data in Table 11 reveal that the mean CCTST total score of the of the 4 year degree group ( $n = 50$ ,  $M = 78.02$ ) was within 1 point (<1% difference) of the CCTST total score mean of the No 4-year degree group ( $n = 50$ ,  $M = 77.26$ ). The results in Table

12 showed that the difference in CCTST total score between junior Army officers with a 4-year degree and junior Army officers with no 4-year degree were not significant.

Table 13

*Descriptive Statistics of CCTST Subscale Scores*

CCTST	<i>M</i>	<i>s</i>	Min Score	Max Score
4-Year Degree ( <i>n</i> = 50)				
CCTST Total	78.02	7.85	61	97
Analysis	78.50	8.76	55	100
Evaluation	75.98	9.74	59	96
Explanation	76.14	10.43	55	100
Inference	80.32	7.61	64	100
Interpretation	84.74	10.67	55	100
Deductive Reasoning	78.16	8.85	61	100
Inductive Reasoning	81.04	7.60	64	95
No 4-Year Degree ( <i>n</i> = 50)				
CCTST Total Score	77.26	7.65	62	93
Analysis	77.60	9.32	60	95
Evaluation	75.94	10.24	55	96
Explanation	75.76	11.01	55	100
Inference	78.66	7.60	64	94
Interpretation	84.00	9.42	68	100
Deductive Reasoning	77.28	7.86	58	95
Inductive Reasoning	80.42	8.12	64	97

*Research Objective 4*

To determine whether there were differences between junior Army officers with a 4-Year degree and junior Army officers with no 4-Year degree in CCTDI total score and subscale scores as identified in Research Objective 4, a MANOVA was performed.

An assumption of MANOVA is homoscedasticity, where covariance matrices of CCTDI and CCTST scores are the same across groups (Hoekstra et al., 2012). To check for equality of covariance matrices, Box's  $M$  test was conducted at  $\alpha = .001$ . For the CCTDI, the test for homogeneity of covariance across groups, Box's  $M$  (41.667), was not significant,  $p = .376$ . This indicates that no significant differences exist between the covariance matrices of CCTDI scores across junior Army officers with a 4-year degree and junior Army officers with no 4-year degree. Therefore, the assumption of homogeneity is not violated and Wilk's  $\Lambda$  is appropriate. The test statistic Wilks's  $\Lambda$  is used in MANOVA to test for differences in the means of different groups on multiple dependent variables (Bartlett, Simonite, Westcott, & Taylor, 2000). Using  $\alpha = .05$ , multivariate analysis on CCTDI total score was not significant, Wilks's  $\Lambda = .91$ ,  $F(8, 91) = 1.04$ ,  $p = .408$ ,  $\eta_p^2 = .08$ , which finds no significant difference in CCTDI scores between junior Army officers with a 4-year degree and junior Army officers with no 4-year degree. A common statistic for the reporting of effect size in MANOVA is eta squared ( $\eta^2$ ), which can present a challenge when using SPSS (Levine & Hullett, 2002; Pierce, Block, & Agunis, 2004). Since the researcher used SPSS for statistical analysis, it is important to report partial eta squared ( $\eta_p^2$ ) as the estimate of effect size, as opposed to eta squared ( $\eta^2$ ) to avoid making reporting errors (Levine & Hullett, 2002; Pierce, Block, & Agunis, 2004). The multivariate  $\eta_p^2$  reflects the percentage of variance in CCTDI scores explained by a 4-year degree in the sample, and Wilks's  $\Lambda$  was weak at .08, indicating 8% of the variance of CCTDI scores associate with a 4-year degree.

Follow-up univariate analyses of variance was conducted for each of the CCTDI subscale score dependent variables, with each evaluated at  $\alpha = .05$ . Results of the follow-up ANOVA tests for the seven CCTDI subscale scores are listed in Table 14.

Table 14

*Results of Follow-Up ANOVAs of CCTDI Subscale Scores*

Measure	<i>F</i>	<i>p</i>	$\eta_p^2$
CCTDI Subscale			
Truthseeking	1.360	.246	.014
Open-Mindedness	.078	.781	.001
Inquisitiveness	.929	.338	.009
Analyticity	.056	.813	.001
Systematicity	2.010	.159	.020
Confidence in Reasoning	2.366	.127	.024
Maturity of Judgement	3.548	.063	.035

Note.  $N = 100$ ,  $\alpha = .05$ ,  $df = 1$

The ANOVAs for each of the CCTDI subscale dependent variables were non-significant, and less than 3% of all subscale variance is related to a 4-year degree. The result of the non-significant multivariate Wilk's  $\Lambda$  ( $p = .408$ ) is consistent with the results of the non-significant CCTDI total score and subscale score ANOVAs, which finds that a 4-year degree did not have a statistically significant effect on critical thinking disposition scores.

*Research Objective 5*

To determine whether there were differences between junior Army officers with a 4-Year degree and junior Army officers with no 4-Year degree in perceived level of critical thinking skill across CCTST total score and subscale scores as identified in Research Objective 5, a MANOVA was performed along with subsequent follow-up

ANOVAs (Table 15). For the CCTST, the test for homogeneity of covariance across groups ( $p < .001$ ) Box's  $M$  (23.826) was not significant,  $p = .971$ . This indicates that no significant differences exist between the covariance matrices of CCTST scores across junior Army officers with a 4-year degree and junior Army officers with no 4-year degree. Therefore, the assumption of homogeneity is not violated, and Wilk's  $\Lambda$  is appropriate (Bartlett et al., 2000). Using  $\alpha = .05$ , multivariate analysis on CCTST total score was not significant, Wilks's  $\Lambda = .97$ ,  $F(8, 91) = .333$ ,  $p = .951$ ,  $\eta_p^2 = .03$ , which finds no significant difference in CCTDI scores between junior Army officers with a 4-year degree and junior Army officers with no 4-year degree. The multivariate  $\eta_p^2$  based on Wilks's  $\Lambda$  was weak at .03, indicating 3% of the variance of CCTDI scores associate with a 4-year degree (Levine & Hullett, 2002).

Table 15

*Results of Follow-Up ANOVAs of CCTST Subscale Scores (n = 100)*

Measure	$F$	$p$	$\eta_p^2$
CCTST Subscale			
Analysis	.247	.620	.003
Evaluation	.135	.714	.001
Explanation	1.189	.278	.012
Inference	.000	.984	.000
Interpretation	.031	.860	.000
Inductive Reasoning	.155	.694	.002
Deductive Reasoning	.276	.600	.003

Note.  $N = 100$ ,  $\alpha = .05$ ,  $df = 1$

Data analysis indicate that the total sample ( $n = 100$ ) achieved a mean CCTST total score of 77.64, which falls within the Strong category (Table 4) for characteristics of reasoned decision-making and problem solving. Multivariate analysis showed no

significant difference in CCTST subscale scores between groups. The two lowest mean CCTST subscales score for both groups were found in Evaluation (4-year degree group [ $M = 75.98, s = 9.74$ ], No 4-year degree group [ $M = 75.94, s = 10.24$ ]), and Explanation (4-year degree group [ $M = 76.14, s = 10.43$ ], No 4-year degree group [ $M = 75.76, s = 11.01$ ]). Evaluation is how one assesses arguments and their credibility, as well as stating opinions and justifying methods (Insight Assessment, 2015b). Explanation skills allow one to assess the credibility of sources and quality of analysis. These two subscales are related in that strong explanation skill supports strong evaluation skill through providing the evidence and rationale behind the premises and assertions supporting arguments (Insight Assessment, 2015b). The highest mean CCTST subscale score for both groups was found in Interpretation (4-year degree group [ $M = 84.74, s = 10.67$ ], No 4-year degree group [ $M = 84.00, s = 9.42$ ]). Interpretation is used to determine the meaning and significance of communication and messaging (Insight Assessment, 2015b). The mean Interpretation subscale score approached the Superior skill level (Table 4) for both groups within 85 points as the threshold (Insight Assessment, 2015b).

The univariate ANOVAs displayed in Table 15 for each of the CCTST subscale dependent variables were non-significant, and 1% or less of all subscale variance is associated with a 4-year degree. The result of the non-significant multivariate Wilk's  $\Lambda$  ( $p = .951$ ) is consistent with the results of the non-significant CCTST total score and subscale score ANOVAs, which finds that a 4-year degree did not have a statistically significant effect on critical thinking skill scores.

*Research Objective 6*

Critical thinking literature delineates critical thinking disposition and skill as two separate elements in people, where critical thinking disposition refers to the willingness to engage in critical thought, and critical thinking skill is the actual ability to think critically (Ennis, 1985; Facione, 1990; Halpern, 1998). To determine the relationships between critical thinking disposition and critical thinking skill within each junior Army officer group as identified in Research Objective 6, Pearson's product moment correlations were used to assess within-group relationships among CCTDI total score and subscale scores, and CCTST total score and subscale scores. CCTDI results are displayed in Tables 16, and CCTST results are displayed in Table 17.

Table 16

*4-Year Degree Group Within-Group CCTDI-CCTST Correlation*

Correlation of CCTDI Total and Subscale Scores with CCTST Total and Subscale Scores - 4-Year Degree Group ( $n = 50$ )									
		CCTST	Analysis	Interpretation	Inference	Evaluation	Explanation	Inductive	Deductive
CCTDI	<i>r</i>	-.015	-.044	.092	.092	-.113	-.036	.135	-.130
	<i>p</i>	.920	.761	.524	.527	.435	.805	.351	.368
Truthseeking	<i>r</i>	-.010	-.087	.069	.071	-.021	.081	.178	-.165
	<i>p</i>	.945	.548	.632	.624	.887	.577	.217	.251
Open-Mindedness	<i>r</i>	-.184	-.111	.028	-.013	-.362**	-.263	-.136	-.178
	<i>p</i>	.200	.442	.846	.929	.010	.065	.345	.216
Inquisitiveness	<i>r</i>	.029	.018	.141	.052	-.085	-.088	.075	-.008
	<i>p</i>	.844	.900	.329	.719	.559	.543	.607	.954
Analyticity	<i>r</i>	.000	-.017	.046	.126	-.131	-.060	.115	-.088
	<i>p</i>	.997	.907	.754	.385	.363	.680	.425	.545
Systematicity	<i>r</i>	.068	-.035	.031	.109	.025	.110	.205	-.070
	<i>p</i>	.638	.809	.832	.452	.865	.448	.152	.628
Confidence in Reasoning	<i>r</i>	.231	.095	.319*	.264	.121	.104	.358*	.088
	<i>p</i>	.106	.511	.024	.064	.403	.472	.011	.543
Maturity of Judgement	<i>r</i>	-.214	-.153	-.151	-.123	-.168	-.114	-.114	-.243
	<i>p</i>	.136	.289	.296	.395	.243	.430	.430	.089

Note.  $r$  = Pearson's product-moment correlation coefficient;  $p$  = level of significance ( $p \leq .05$ );

\* = Correlation is significant at the 0.05 level; \*\* = Correlation is significant at the 0.01 level



For junior Army officers with a 4-year degree, Pearson product-moment correlation calculations were computed among the CCTDI total score and 7 subscale scores and CCTST total score and 7 subscale scores. The results show that 3 out of 64 correlations (5%) were statistically significant at  $p \leq .05$ . As shown in Table 16, the CCTDI subscale Confidence in Reasoning was significantly correlated with the CCTST subscale Interpretation,  $r(48) = .319, p = .024$ , and the CCTST subscale Induction,  $r(48), = .358, p = .011$ . The correlation between the CCTDI subscale Open-Mindedness and the CCTST subscale Evaluation was significant,  $r(48), = -.362, p = .010$ , and is a significant negative correlation. All other correlations were not significant at  $p < .05$ . The study results showed that with this sample group of junior Army officers with a 4-year degree, the correlation between the overall disposition toward critical thinking and overall critical thinking ability was not significant ( $p < .05$ ).

Previous studies, which examined the relationship between critical thinking disposition and skill, have found significant positive correlation (Colucciello, 1997; Facione et al., 1992; McCarthy et al., 1999). Of potential concern to Army leaders is the significant negative correlation between Open-mindedness and Evaluation in the 4-year degree group. This indicates that junior Army officers who possess the traits of Open-mindedness (objective, tolerant, appreciative of others views and opinions) may not be objective when it comes to how one assesses arguments and their credibility, nor open-minded in determining the strength or weakness in an argument. The large number of negative correlations between dispositional attributes and cognitive skill is indicative of a lack of parity between the willingness to think critically and the skill to engage in critical thought.

Table 17

*No 4-year Degree Group Within-Group CCTDI-CCTST Correlation*

Correlation of CCTDI Total and Subscale Scores with CCTST Total and Subscale Scores - No 4-Year Degree Group ( $n = 50$ )									
		CCTST	Analysis	Interpretation	Inference	Evaluation	Explanation	Inductive	Deductive
CCTDI	<i>r</i>	.388**	.269	.262	.322*	.303*	.324*	.310*	.363*
	<i>p</i>	.005	.059	.066	.022	.032	.022	.028	.010
Truthseeking	<i>r</i>	.246	.078	.229	.260	.162	.103	.221	.224
	<i>p</i>	.086	.589	.109	.068	.260	.475	.124	.118
Open-Mindedness	<i>r</i>	-.066	-.144	.046	-.033	-.111	-.151	-.052	-.092
	<i>p</i>	.648	.318	.751	.822	.443	.294	.720	.524
Inquisitiveness	<i>r</i>	.225	.160	.105	.162	.209	.219	.218	.166
	<i>p</i>	.116	.267	.467	.262	.144	.127	.128	.248
Analyticity	<i>r</i>	.412**	.310*	.279*	.336*	.320*	.428**	.355*	.371**
	<i>p</i>	.003	.028	.050	.017	.023	.002	.011	.008
Systematicity	<i>r</i>	.387**	.358*	.156	.292*	.367**	.440**	.282*	.404**
	<i>p</i>	.005	.011	.279	.040	.009	.001	.047	.004
Confidence in Reasoning	<i>r</i>	.441**	.321*	.307*	.334*	.365**	.410**	.315*	.438**
	<i>p</i>	.001	.023	.030	.018	.009	.003	.026	.001
Maturity of Judgement	<i>r</i>	.356*	.286*	.229	.310*	.260	.245	.268	.356*
	<i>p</i>	.011	.044	.109	.028	.068	.086	.060	.011

Note.  $r$  = Pearson's product-moment correlation coefficient;  $p$  = level of significance ( $p \leq .05$ );

\* = Correlation is significant at the 0.05 level; \*\* = Correlation is significant at the 0.01 level

For junior Army officers with no 4-year degree, Pearson product-moment correlation calculations were computed among the CCTDI total score and 7 subscale scores and CCTST total score and 7 subscale scores. The results show that 33 out of 64 correlations (52%) were statistically significant at  $p < .05$ . As depicted in Table 17, two of the CCTDI subscales, Analyticity and Confidence in Reasoning, were significantly positively correlated with all 7 CCTST subscales. CCTDI subscale Systematicity was significantly positively correlated with 6 of the 7 CCTST subscales, with the exception of Interpretation,  $r(48) = .156, p = .279$ . The correlation between the CCTDI subscale Maturity of Judgement was significantly correlated with the CCTST subscales of Analysis,  $r(48) = .286, p = .044$ , Inference,  $r(48) = .310, p = .028$ , and Deduction,  $r(48) = .356, p = .011$ . All other correlations were not significant at  $p < .05$ . The researcher observed that within the No 4-year degree group, the CCTDI subscale Open-Mindedness was negatively correlated with 6 of 7 CCTST subscales, with the exception of Interpretation,  $r(48) = .046, p = .751$ . The study results find that with this sample group of junior Army officers with no 4-year degree, the correlation between the overall disposition toward critical thinking and overall critical thinking ability was significant ( $p < .05$ ).

The strong, positive correlation between disposition and skill in the No 4-year degree group is in stark contrast to the 4-year degree group, where only three correlations between disposition and skill were significant. Two of the CCTDI subscales, Analyticity and Confidence in Reasoning, were significantly positively correlated with all 7 CCTST subscales. Analyticity, the concept of one being alert to the outcomes of decision-making and being able to anticipate their effects, falls within strategic thinking in the military

context, a necessary Army leader trait (Franke, 2011). As such, this may be one of the most important affective traits of Army leaders relative to critical thinking. Confidence in reasoning relates to the habit of mind to engage in reflective thought in order to solve problems and make decisions. Decision-making and problem solving are essential leadership traits the Army must continue to develop in its leaders (Hatfield et al., 2011). Education literature has found a significant relationship between critical thinking disposition and problem solving skill (Tümakaya et al., 2009). The relationship between critical thinking disposition and skill was positive and significant for the No 4-year degree group ( $p = .001$ ), and all 33 significant correlations were positive, in contrast to the 4-year degree group who only had three significant correlations of which one was negative.

### Summary

The purpose of this study was to measure perceived levels of critical thinking talent of two groups of junior Army officers with different levels of education, and determine if differences exist between the two groups. Two well-established, reliable and valid instruments were used to measure junior Army officer perceived critical thinking disposition and skill. One group of junior Army officers ( $n = 50$ ) all possessed a 4-year college degree, and another group of junior Army officers ( $n = 50$ ) had no 4-year degree. The Army identifies critical thinking as one of the most important leader competencies (DA, 2013; Gerras, 2008; Fischer et al., 2009; Schumm, et al., 2010; Thomas & Gentzler, 2013). Education literature reveals that critical thinking develops through higher education (Abrami et al., 2008; Behar-Hohenstein & Niu, 2011; Duron, et al., 2006; Liu, et al., 2014; Nusche, 2008; Pellegrino & Hilton, 2012; Tiruneh et al., 2014), yet

industrial-organizational psychology literature describes college graduates are not meeting the critical thinking outcomes expected of the workforce (Carmel & Yeziarski, 2013; Flores et al., 2012; Laird et al., 2014; Ritchie et al., 2015; Saveedra & Saveedra, 2011). This tension identifies a gap in the literature resulting from the conflicting research on the effects of college education on level of perceived critical thinking talent in the workforce.

Results of this study find statistically significant differences between groups in age, years of military service, as well as which critical thinking dispositional subscales correlate with critical thinking skill subscales. However, the difference in critical thinking disposition and critical thinking skill of junior Army officers with a 4-year degree and junior Army officers with no 4-year degree were not significant. The next chapter will discuss the results of the study presented in Chapter IV as well as their implications. Study limitations and recommendations for future research will also be presented.

## CHAPTER V

### SUMMARY

The preceding chapters discussed the need for the Army to develop a deeper understanding of the level of critical thinking talent across the Army workforce, and the methods that may or may not develop critical thinking talent. This chapter discusses the findings and conclusions of the study in detail, as well as study limitations. The researcher proposes additional areas for study, and confirms the need for future research.

The unpredictable and complex operating environment the Army faces in the future requires Army leaders to possess critical thinking talent as an essential leader competency. The ability to solve complex, ill-defined problems and to make sound, yet timely, decisions with imperfect information requires leaders to possess the attributes characterized in the 14 CCTDI and CCTST subscales. The extensive literature review presented in Chapter II allowed the researcher to develop a deeper understanding of critical thinking disposition and critical thinking skill. As an essential Army leader competency, literature reveals individuals develop critical thinking talent through higher education. Literature also reveals that many college graduates are not meeting the expected critical thinking outcomes of the workforce (Laird et al., 2014; Liu et al., 2014), yet this point may be less relevant as 78% of the Army's workforce does not possess a college degree (DoD, 2013).

Tension exists in the literature relating to how one develops critical thinking disposition and skill (Flores et al., 2012; Saveedra & Saveedra, 2011), and this tension forms the research problem which informed the current study. This study adds to the body of knowledge by establishing a framework of the level of junior Army officers'

critical thinking talent, and a deeper understanding of the relationship between junior Army officers' critical thinking disposition and skill. After achieving the goals of the study's research objectives, the next section will discuss the findings of this study and the insights each provide regarding junior Army officer critical thinking talent across level of education.

The population under study was junior Army officers. This study took place in winter of 2015-2016 using purposive, non-random sampling of 100 junior Army officer participants at a large military post in the southeast. Junior Army officers were organized into two groups: one group of Army lieutenants all of whom possessed a 4-year degree and a second group consisting of Army warrant officers where none possessed a 4-year degree. All participants were members of the same branch of the Army. Two critical thinking instruments were used in this study: the California Critical Thinking Disposition Inventory (CCTDI) and California Critical Thinking Skills Test (CCTST), both developed by Facione (1990). The CCTDI measured the seven attributes that influence an individual's capacity to learn and apply critical thinking skills (Insight Assessment, 2015a), and the CCTST measured the seven core-reasoning skills needed for reflective decision-making (Insight Assessment, 2015b).

Participants were administered the CCTDI and CCTST in their normally assigned classroom, utilizing their government issued laptop computers. Data were analyzed using IBM SPSS predictive analytic software version 21.0. The independent variable in this study was a 4-year college degree. Since this study's design was to determine differences between groups, a one-way multivariate analysis of variance (MANOVA) was utilized to analyze the data. To determine the strength of the within-group relationship between

critical thinking disposition and skill, Pearson's product-moment correlation  $r$  was conducted to measure this associative relationship strength. Multivariate, univariate, and correlation analysis significance was set a priori at  $\alpha = .05$ .

#### Junior Army Officer Demographics

The junior Army officers who participated in this study are representative of typical junior Army officer students across the Army. Lieutenants and warrant officers are commissioned and appointed, respectively, through their separate developmental courses, then sequenced through their respective officer basic courses throughout the course of the calendar year. Based on these accessions sources, lieutenants are typically younger than warrant officer one's, and have fewer years of service (DA, 2005). The participants in the sample are representative of junior officers across the Army beginning their careers.

#### *Findings*

In this study, the differences in age and years of service between the two groups were statistically significant. However, when utilized as covariates for MANCOVA, age and years of service were not significantly correlated to critical thinking scores. Research Objective One revealed that as workforce members age and gain more work experience, their level of critical thinking talent does not change linearly.

#### *Conclusions*

Mean participant age between the two groups only differed by 3.5 years, which may have been too narrow a span of time to measure the effect of age. The same effect may have occurred with years of service as the mean difference between groups was 5.42 years. When scored on the CCTDI, age related only to the CCTDI subscales of Maturity



of Judgement and Confidence in Reasoning, and to none of the seven CCTST subscales. None of the 14 CCTDI and CCTST subscales related to years of service. These conclusions are consistent with other studies that examined participant age and experience (Naber & Wyatt, 2014; Simmons, 2014) and found that neither were related to level of critical thinking talent. Higher levels of critical thinking talent may not develop until officers are in their thirties, which is too late in the officer career timeline.

### *Recommendations*

Although this study, supported by the literature, found age and years of service are not significantly correlated with level of critical thinking talent, the complex operating environment requires junior Army officers to have these skills now (DA, 2012a). The Army should shape the critical thinking outcomes it requires of its junior leaders through early education intervention. Consistent with the literature (Facione, 1990; Halpern, 1999; Halpern & Nummedal, 1995; Naber & Wyatt, 2014), critical thinking is a cognitive process that students can learn. This research prompts the Army to expose junior Army officers to intensive critical thinking talent instruction as early as possible in the education continuum in order for the Army to achieve sustainable critical thinking outcomes.

### Critical Thinking Disposition

Critical thinking is more than the application of cognitive skill in context (Halpern, 1998). As described by Giancarlo and Facione (2001), a holistic view of critical thinking must include a person's willingness to engage in critical thought when making decisions or solving problems. This affective attribute is important to Army leaders as Army doctrine describes the decisions leaders make as an essential element of

command which “ultimately guide the actions of the force” (DA, 2012a). The following relates to the characterological attributes manifested in critical thinking disposition.

### *Findings*

Results of statistical analysis showed no significant difference in CCTDI subscale scores between groups. The strong evidence supported by the education literature (Abrami et al., 2008; Colucciello, 1997; Liu et al., 2014; Tiruneh et al., 2014) reveals one would expect the 4-year degree group to have significantly higher CCTDI scores than the No 4-year degree group, but this was not the finding in the data analysis. The follow-up ANOVA statistical analysis determined there was no difference in critical thinking disposition across the seven CCTDI subscales.

The CCTDI scores between groups were not significantly different, and were indeed quite similar in ranking from highest mean subscale score (Inquisitiveness) and lowest mean subscale score (Truthseeking). The low scores in the subscale Truthseeking is attributed to level of education (N.C. Facione et al., 1994), which in the current study references baccalaureate-level education. Higher level education, graduate education in this reference, develops the courage to ask questions and pursue inquiry (N.C. Facione et al., 1994) as the more desirable characteristics of Truthseeking. A potential effect on critical thinking skill discussed in the next section, Truthseeking may be the most essential dispositional attribute in predicting critical thinking skill (P.A. Facione et al., 1995). One of the principles of Army Mission Command (DA, 2012a) is for commanders to create shared understanding with their subordinates and subordinates’ clear understanding of the commander’s intent. Since Truthseeking is the habit of seeking the best possible understanding of a given situation (Insight Assessment, 2015a),

it is of concern to the Army that both groups scored the lowest on the Truth seeking subscale.

### *Conclusions*

The multivariate analysis results of MANOVA revealed that only 8% of the variance in the sample test critical thinking disposition scores was explained by a 4-year degree, which was supported in the literature (Flores et al., 2012; Ritchie et al., 2015; Saavedra & Saavedra, 2011) relative to the number of college graduates not meeting expected critical thinking outcomes. This may be indicative of a larger post-secondary education institutional challenge, as all study participants in the 4-year degree group did not graduate from the same college or university. Critical thinking disposition, as the affective attribute of one being willing to engage in critical thought, is an essential attribute to that which the Army desires in its leaders (Fischer et al., 2008, 2009). Tolerance of ambiguity, preference for order, and spontaneity are all dimensions on which people differ (Lizzio & Wilson, 2007). It is essential to acknowledge that disposition is not a skill, but an affective willingness to think critically (P.A. Facione et al., 1995). As such, it may not be reasonable to assume that a willingness to engage in critical thought should be an outcome of higher education (P.A. Facione et al., 1995). This study finds that junior Army officer college graduates scored no better on a critical thinking disposition instrument than non-college graduate junior Army officers, which may also be a point of potential concern for the Army.

### *Recommendations*

This study revealed college education had no statistically significant effect on junior Army officer willingness to engage in critical thought. If the Army expects its

leaders to operate in chaotic environments and develop creative solutions to complex, ill-defined problems, it is recommended that Army leader development institutions adapt to provide specific critical thinking disposition education, which can develop the affective attributes necessary to engage in critical thought (Dietz & Schroeder, 2012). The disposition to think critically is separate from the ability to think critically, and it will likely take time for the Army to develop educational strategies to develop dispositional attributes (Halpern, 1998). Effective dispositional teaching strategies can accelerate the process of learning, which can enable the Army to achieve its desired leader development outcomes (Fischer et al., 2008, 2009; Yeo & Marquardt, 2015).

#### Critical Thinking Skill

The Army desires its leaders to be talented critical thinkers (Fischer et al., 2008, 2009; Gerras, 2008; Thomas & Gentzler, 2013). Cognitive reasoning and problem solving are indeed complex constructs, but are capable of being measured, analyzed, and improved (Insight Assessment, 2015b). The following relates to the strength to form reflective judgment about what to believe or do manifested in critical thinking skill.

#### *Findings*

This study finds no statistically significant difference between junior Army officers with a 4-year degree and those with no 4-year degree, an outcome that was not expected based on the education literature. Where critical thinking disposition describes the attributes that influence an individual's capacity to learn and willingness to engage in critical thought (Insight Assessment, 2015a), critical thinking skill applies to an individual's ability to reason, identify assumptions, and evaluate arguments in the process of reflectively deciding what to believe or do (Insight Assessment, 2015b).

Junior Army officers with a 4-year degree and junior Army officers with no 4-year degree scored in the 59th and 55th percentiles, respectively, of an aggregate sample of 4-year college student CCTST test-takers. Introduced in the previous section, Truthseeking may be the most important dispositional attribute related to critical thinking skill (Facione et al., 1995). If Truthseeking is indeed the most important attribute related to critical thinking skill, this may be a point of concern for the Army, since the lowest CCTDI subscale score for both groups was the attribute Truthseeking (Table 11).

### *Conclusions*

Junior Army officer critical thinking skill scores identified in the findings appear average, based on their CCTST 4-year college student normed percentile scores. Education literature holds that higher education expects to produce graduates who are capable of engaging in critical thought (Abrami et al., 2008; Halpern, 1999; Pellegrino & Hilton, 2012; Tiruneh et al., 2014), yet the findings of this study are inconsistent with this claim. As discussed by Flores et al. (2012), “mere education does not necessarily lead to better thinkers” (p. 212). No significant variance exists between groups in CCTST subscale comparison; indeed the analysis reveals the opposite. What is not known are the variables that contributed to the No 4-year degree group getting statistically similar critical thinking scores to the 4-year degree group.

### *Recommendations*

The Army expects its leaders to operate against an elusive, adaptive enemy who will work against the Nation’s interests asymmetrically (McMaster, 2015). To operate successfully in such an environment, especially as one expected to lead others through ambiguity and chaos, junior Army officers scoring in the normed 55th and 59th percentile

of critical thinking skill may not be indicative of the levels of cognitive readiness the Army requires in its leaders. If baccalaureate education did not produce the level of critical thinking talent expected, the Army should consider developing a framework for critical thinking in its own education continuum. Carafano (2009) and Petraeus (2007) both describe graduate education as the means to developing the cognitive readiness needed of Army leaders. Since 78% of the Army's workforce does not possess a college degree, developing graduate-level learning outcomes for the entire Army would be an ambitious undertaking. Complex problem-solving and reasoned decision-making require cognitive skills that, similar to critical thinking disposition, the Army should begin to develop in leaders sooner rather than later. This study reveals that a 4-year college degree had no significant effect on the ability to engage in critical thought as compared to officers with no 4-year degree, a finding that should be of concern to senior Army leaders.

#### Relationship Between Disposition and Skill

Army leader development processes can improve soldiers' cognitive abilities through developing both critical thinking disposition and critical thinking skill (DA, 2014b). Understanding the important relationship between critical thinking disposition and critical thinking skill can enable Army education professionals to develop effective and efficient critical thinking curricula. Critical thinking programs should include methods for developing intellectual character and cognitive skill concurrently (Facione, Facione, & Giancarlo, 2000).

### *Findings*

Data analysis show only 5% of the 4-year degree group's critical thinking dispositional attributes significantly correlated with critical thinking skill attributes. Facione (2015) describes the relationship between critical thinking disposition and critical thinking skill as pervasive, in that thoughtful judgment and reflective decision-making is of perpetual value to problem solving and decision-making. Indeed, a complex, rapidly evolving operating environment requires Army leaders to possess mental agility that is second nature (Franke, 2011). One may expect a cognitive skill to be of little value without the disposition to use it. In contrast, the No 4-year degree group showed a strong positive correlation between disposition and skill, with 52% of the dispositional subscales correlating with skill subscales. The conscious application of cognitive, attitudinal, and knowledge skills are necessary for competent critical thinking (Miller & Tucker, 2015).

Developing critical thinking-focused military education strategies to achieve optimized workforce performance may be the solution for the Army to develop the cognitive and attitudinal skills necessary for success in a complex, rapidly evolving operating environment. Discussed by Papparone (2014) in his article on Army critical thinking, the Army could consider incorporating Action Learning as a methodology to teach critical thinking (Yeo & Marquardt, 2015), however, potential solutions are beyond the scope of this research.

### *Conclusions*

The researcher concluded the relationship between CCTDI and CCTST scores within groups were not similar. The correlation between critical thinking disposition and

skill was not significant for the 4-year degree group, but was significant for the No 4-year degree group. The No 4-year degree group's scores may be due to the group's significant positive correlation between critical thinking disposition and skill. Education literature has found a significant relationship between critical thinking disposition and problem solving skill (Tümakaya et al., 2009). One of the possible reasons the 4-year degree group did not score higher on either the CCTDI or CCTST was their low disposition-skill relationship. The Army should explore the underlying constructs of the non 4-year degree holder's critical thinking scores, and conduct research to reveal the variables that led the No 4-year degree group to displaying such a strong disposition - skill relationship.

#### *Recommendations*

Supported by the critical thinking literature (Ennis, 1985; Facione, 1990; Halpern, 1998), this study revealed that the relationship between critical thinking disposition and skill might be a contributing variable in developing overall critical thinking talent. Army education professionals, understanding the relationship between disposition and skill, can shape the framework of critical thinking education curricula. It is therefore recommended that Army education institutions develop a deeper understanding of the affective domain of disposition as a means to improving the cognitive readiness of Army leaders. Further thought is necessary about Junior Army officers with different levels of education having no significant difference in critical thinking scores, but statistically different relationships between the willingness to engage in critical thought and the actual skill to think critically.



### Implications of Study Limitations

To develop a deeper understanding of the level of critical thinking talent of Army leaders, future research should expand beyond the limits of this study by measuring a broader scope of Army leaders, to include mid-grade and senior leaders. Additionally, since this study only measured junior Army officers from one branch of the Army on a single Army installation, expanding research to include multiple branches of the Army across multiple installations should provide a deeper understanding of the level of critical thinking talent across the Army in an organizational context. These considerations may limit the generalizability of the current study's findings beyond the setting in which it occurred, especially since so few Army installations have access to such a large population of junior Army officers with varying levels of education.

This study utilized the construct of critical thinking and its related instruments as described by the consensus definition derived from the 1990 APA Delphi Study (Facione, 1990). However, the Army could use other suitable critical thinking instruments, as discussed in Chapter II, to measure the critical thinking of Army leaders.

The current study did not consider broader level of education of the No 4-year degree group, and some participants in the No 4-year degree group may have attended college at some earlier point, but never earned a 4-year degree. This study did not consider where the 4-year degree students obtained their degree, nor inquired as to their college major, both of which may be variables to consider for future research.

### Recommendations for Future Research

- Measure Army leader critical thinking skill at progressive educational milestone points in a leader's career, such as the Captains Career Course,

the Command and General Staff College, and the Senior Service Education.

- Replicate this study including the relationship between level of critical thinking talent and college major, as well as college attended.
- Replicate this research on other Army installations, and include leaders from multiple branches of the Army.
- Utilize larger sample sizes through random sampling, which will enrich external validity and provide stronger generalization to the population.

### Summary

This study examined critical thinking as a method to optimize workforce performance through examining perceived Army officer critical thinking talent across level of education. In light of the research objectives, the Army will begin to understand that higher education may not have the relationship with level of critical thinking talent as expected. The evidence presented in the study is relevant for research, policy and practice. The study adds to the body of knowledge of workforce development and performance improvement literature, as purported methods of developing essential workforce competencies were explored. Analysis of the differences in critical thinking talent between junior Army officer groups revealed some thought-provoking findings. Data analysis show differences between groups' CCTDI and CCTST scores as not significant, and indicate strong similarities across CCTDI and CCTST total score and subscale scores. Each group's scores were quite similar to the other, with the only significant difference between groups found to be the within-group relationship between critical thinking disposition and critical thinking skill. The 4-year degree group had no

significant correlation between disposition and skill, and the No 4-year degree group had strong positive correlation between disposition and skill. What is unknown are the variables that contributed to junior Army officers with no 4-year degree to have similar critical thinking scores of a junior Army officers with a 4-year degree. Utilizing the affective dimension of critical thought (disposition) may be the variable that led to the non-college educated group of junior Army officers to score in the 55th percentile of a critical thinking instrument (CCTST) normed to 4-year college students.

Petraeus (2007) and Fastabend (2004) purport that graduate education, not baccalaureate education, may provide the cognitive development Army leaders need to be successful in a complex operating environment. The Army must give careful attention to curriculum design, specifically regarding traditional classroom instruction, where lecture-style methods fail to engage students and develop self-reflective thought, and does not lead to critical thinking (Lizzio & Wilson, 2007; Yeo & Marquardt, 2015).

If the Army desires its leaders to be talented critical thinkers in order to thrive in a chaotic operating environment against adaptive adversaries, active measures should be in place to facilitate this outcome. The study's results make it imperative for the Army to consider adding explicit critical thinking instruction across the leader development model as baccalaureate education may not be meeting the critical thinking outcomes the Army expects of college graduates. Incorporating critical thinking education, accounting for critical thinking disposition and skill as separate but essential components of critical thinking, into the Army education continuum can help the Army achieve its goals of optimizing human performance across its workforce, thereby maintaining a long-term cognitive competitive advantage against the Nation's adversaries.

## APPENDIX A

## INSTITUTIONAL REVIEW BOARD NOTICE OF COMMITTEE ACTION



**INSTITUTIONAL REVIEW BOARD**  
 118 College Drive #5147 | Hattiesburg, MS 39406-0001  
 Phone: 601.266.5997 | Fax: 601.266.4377 | [www.usm.edu/research/institutional.review.board](http://www.usm.edu/research/institutional.review.board)

**NOTICE OF COMMITTEE ACTION**

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months.  
 Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: 15120701  
 PROJECT TITLE: Optimizing Workforce Performance: Perceived Differences of Army Critical Thinking Talent Across Level of Education  
 PROJECT TYPE: New Project  
 RESEARCHER(S): Richard Ayers  
 COLLEGE/DIVISION: College of Science and Technology  
 DEPARTMENT: Human Capital Development  
 FUNDING AGENCY/SPONSOR: N/A  
 IRB COMMITTEE ACTION: Exempt Review Approval  
 PERIOD OF APPROVAL: 12/09/2015 to 12/08/2016  
**Lawrence A. Hosman, Ph.D.**  
**Institutional Review Board**

## APPENDIX B

## U.S. ARMY-SPECIFIC RESEARCH CONSIDERATIONS STATEMENT

## Exceptions and Exemptions of Army Requirements

In accordance with Appendix F, paragraph F-1 of Army Regulation 70-25, *Research and Development: Use of Volunteers as Subjects of Research*, dated 25 January 1990, this research constitutes activities in which human subjects are involved in one or more of the categories that are *exempt* from the requirements of this regulation. Specifically, as identified in paragraph F-1c., the current research involves the use of educational tests where the data is recorded in such a way that subjects cannot be identified directly or indirectly, and is therefore exempt. All participants from both groups were anonymous for the administration of both the CCTDI and CCTST, and no personally identifiable information was requested from study participants. All participants were members of the same Army organization at the battalion level.

## Exceptions and Exemptions of DoD Requirements

The current research is also exempt from Department of Defense Instruction 1100.13, *DoD Surveys*, dated 15 January 2015, where paragraph 2b(1) states that this Instruction does not apply to a Department of Defense Component (in this reference the U.S. Army as a military service) conducting a survey from only one Department of Defense Component. Data collected will not be across Department of Defense Components, as the researcher is an active duty Army officer, and current research participants are all members of the U.S. Army, a single component under Department of Defense Instruction 1100.13.

## APPENDIX C

MEMORANDUM AUTHORIZING UTILIZATION OF STUDENT OFFICERS FOR  
RESEARCH

**DEPARTMENT OF THE ARMY**  
 UNITED STATES ARMY WARRANT OFFICER CAREER COLLEGE  
 BLDG 5302 OUTLAW STREET  
 FORT RUCKER, ALABAMA 36362-5000

REPLY TO  
 ATTENTION OF:

ATSW-CDD

30 November 2015

MEMORANDUM FOR Commander, 1st Aviation Brigade, U.S. Army Aviation Center of Excellence, Fort Rucker. AL 36362,

SUBJECT: Utilization of Student Officers for Participation in Doctoral Research

1. The purpose of this memorandum is to request permission to collect data from LT and WO1 student aviation officers currently enrolled in their respective BOLC and WOBC courses.
2. The principal researcher is an active duty warrant officer and doctoral candidate with the University of Southern Mississippi. The subject of research is differences in perceived level of critical thinking disposition and skill between junior Army officers with different levels of education. The population under study is junior Army officers, and the two sub-groups are junior Army officers with a 4-year degree, and junior Army officers with no 4-year degree.
3. In support of collecting data necessary to complete the dissertation, participants from each group will take two web-based instruments to measure critical thinking disposition and skill. The two web-based instruments are the California Critical Thinking Disposition Inventory, and the California Critical Thinking Skills Test. Both are commercial instruments with well-established reliability and validity, and both have been in use for research for over 20 years.
4. The research design calls for 50 LTs and 50 WO1s to complete the instruments. The total time to take both instruments is approximately one hour. The researcher will be sure to coordinate closely with BOLC and WOBC cadre to minimize disruption to student schedules. Student classrooms will be utilized for data collection for student convenience. Student participation is voluntary and anonymous, and no PII is disclosed during the administration of the instruments.
5. In support of ongoing Army efforts, this research also directly addresses Army Warfighting Challenge No. 9, Improve Soldier, Leader, and Team Performance, and No. 10, Develop Agile and Adaptive Leaders.
6. POC is the undersigned, at DSN 558-9031, or richard.b.ayers2.mil@mail.mil

  
 RICHARD B. AYERS  
 CW5, USA  
 Principal Researcher

## APPENDIX D

THE UNIVERSITY OF SOUTHERN MISSISSIPPI AUTHORIZATION TO  
PARTICIPATE IN RESEARCH PROJECT

(Short Form - to be used with oral presentation)

Participant's Name \_\_\_\_\_

The participant is hereby giving consent to be included in a research project entitled:  
*Optimizing Workforce Performance: Perceived Differences of Army Officer Critical Thinking Talent Across Level of Education*

All procedures and/or investigations to be followed and their purpose, including any experimental procedures, were explained by \_\_\_\_\_. Information was given about all benefits, risks, inconveniences, or discomforts that might be expected. Specifically, participation in this study poses no known risks or hazards.

The tests will be administered where the junior Army officers currently attend military courses of instruction on a military installation. The opportunity to ask questions regarding the research and procedures was given. Participation in the project is completely voluntary, and participants may withdraw at any time without penalty, prejudice, or loss of benefits. All information is strictly confidential, and no names will be disclosed. All data will be stored in a password protected electronic format.

Questions concerning the research, at any time during or after the project, should be directed to Richard Ayers at (334) 255-9031. This project and this consent form have been reviewed by the Human Subjects Protection Review Committee, which ensures that research projects involving human subjects follow federal regulations.

Any questions or concerns about rights as a research participant should be directed to the Chair of the Institutional Review Board, The University of Southern Mississippi, 118 College Drive#5147, Hattiesburg, MS 39406-0001, (601) 266-6820.

\_\_\_\_\_  
Signature of participant\_\_\_\_\_  
Date\_\_\_\_\_  
Signature of person explaining the study\_\_\_\_\_  
Date

## ORAL PRESENTATION

The following information should be included:

1. Purpose: The purpose of this study is to determine if differences in critical thinking scores exist between junior Army officers with and without a 4-year degree. This study is conducted by Richard Ayers, a doctoral candidate at The University of Southern Mississippi in partial fulfillment of a Ph.D. in Human Capital Development.
2. Description of Study: Two web-based tests will be administered to two groups of junior Army officers. The two tests together will take approximately 75 minutes to complete (30 and 45 minutes respectively). Both tests are timed, and participants are presented with a timer to know how much time is remaining. When the participants log in to the test site, they answer demographic questions as to their level of education, and years of military service. The researcher will be present to answer any questions until all participants have completed both tests. Data collected from the instruments will help the Army determine the relationship of a college degree and years of military service to critical thinking.
3. Benefits: Group results of the study will be made available to the Commander of the participants. If desired, you may voluntarily provide a civilian e-mail address to Insight Assessment to receive feedback on your test scores.
4. Risks: Participation in this study poses no known risks or hazards.
5. Confidentiality: Participation in the study is strictly voluntary. Demographic information (level of education and years of service) will remain confidential and protected. No names will be disclosed, and all responses will be reported in the aggregate. No PII is disclosed during the administration of these tests. Any request you make to Insight Assessment regarding feedback on your test scores will be between you and Insight Assessment, and will not include the researcher.
6. Participants Assurance: This project has been reviewed by the Human Subjects Protection Review Committee, which ensures that research projects involving human subjects follow federal regulations. Any questions or concerns about rights as a research participant should be directed to the Chair of the Institutional Review Board at (601) 266-6820. Participation in this project is completely voluntary, and participants may withdraw from this study at any time without penalty, prejudice, or loss of benefits. Any questions about the research should be directed to Richard Ayers at (334) 255-9031.

---

Signature of Person Giving Oral Presentation

Date



## APPENDIX E

## SAMPLE CCTDI QUESTIONS

Sample CCTDI and CCTST Questions Provided by Insight Assessment.

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Sample California Critical Thinking Disposition Inventory Questions

Retrieved from: <http://www.insightassessment.com/Resources/Sample-Items-for-Measuring-Thinking-Attributes/%28language%29/eng-US>

*The sample "agree-disagree" style items on this page illustrate the types of statements that could appear on a college or adult level measure of critical thinking habits of mind. The topics and reading levels of statements used on attribute assessments intended for use with children or with professional groups are aligned with the common interests and the educational levels of those populations.*

***Consider the following statements about beliefs, opinions, values, and preferences. Decide whether you agree or disagree with each one. Remember that since you are being asked about your own beliefs, opinions, values, and preferences, there really is no "right" or "wrong" response. The answer is whatever you say it is for you.***

Use the following choices to express your view.

- 6 = Agree Strongly
- 5 = Agree
- 4 = Agree Marginally
- 3 = Disagree Marginally
- 2 = Disagree
- 1 = Disagree Strongly

1. People say I ask challenging questions.
2. I won't let what scientists might say weaken my core beliefs.
3. I prefer jobs where the supervisor says exactly what to do, and exactly when and how to do it.
4. It's important to me to figure out what people really mean by what they say.
5. Don't kid yourself, changing your mind is a sign of weakness.
6. I always do better in jobs where I'm expected to think things out for myself.
7. I hate it when people just shout their opinions without letting others give their views too.

8. There is never any good reason for believing one thing rather than another.
9. Being organized about your plans and projects is way over-rated.
10. Don't try to think ahead because it is impossible to know exactly what the future holds.

## APPENDIX F

## SAMPLE CCTST QUESTIONS

Sample CCTDI and CCTST Questions Provided by Insight Assessment.

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Sample California Critical Thinking Skills Test Questions

Retrieved from: [www.insightassessment.com/Resources/Sample-Items-for-Measuring-Thinking-Attributes/%28language%29/eng-US](http://www.insightassessment.com/Resources/Sample-Items-for-Measuring-Thinking-Attributes/%28language%29/eng-US)

The sample skills test questions on this page are intended to illustrate the types of questions which might appear on a generic adult level reasoning skills test. However, the topics, reading levels, and degree of difficulty of the questions used on actual tests match the educational level and/or professional interests of the population for which a given test is designed. Some versions of these tests include a greater proportion of items which call for numeracy, as illustrated by Sample Item #6. To view a specific test qualified purchasers should purchase the preview pack for the test most appropriate for use with their intended test takers.

**Instructions:** *Form a reflective and reasoned judgment with regard to which choice is the best from among those offered.*

**Background for Sample Thinking Skills Questions 1-3**

**For Sample Questions 1, 2 and 3 Please consider this information :** A scientific study compared two matched groups of college women. The women in both groups were presented with information about the benefits of a healthy diet and regular exercise. The women in one group were paired up with one another and encouraged to work as two-person teams to help each other stick with the recommended healthy regimen of smart eating and regular vigorous exercise. The women in the other group were encouraged to use the same recommended regimen, but they were also advised to work at it individually, rather than with a partner or teammate. After 50 days the physical health and the well-being of all the women in both groups were evaluated. On average the women in the first group (with teammates) showed a 26 point improvement in measures of cardiopulmonary capacity, body strength, body fat reduction, and sense of well-being. On average the women in the other group (encouraged to work as individuals) showed a 17 point improvement on those same measures. Using statistical analyses the researchers determined that the probability that a difference of this size had occurred by chance was less than one in 1000.

**Sample Thinking Skills Question #1.**

If true, these research findings would tend to support which of the following assertions?

- A = A college woman cannot achieve optimal health functioning without a teammate.
- B = Universities should require all students living in campus residence halls to participate in a health regime of smart eating and regular vigorous exercise.
- C = A healthy diet will cause one to have better mental health and physical strength.
- D = This research study was funded by a corporation that makes exercise apparel.
- E = A regimen of smart eating and regular exercise is related to better health.

**Sample Thinking Skills Question #2.**

If the information given in the case above were true, which of the following hypotheses would not need to be ruled out in order to confidently claim that for the majority of young adults a regimen of smart eating and regular vigorous exercise will result in significant improvements in one's overall health.

- A = This study was about women, the findings cannot be generalized to include men.
- B = Since the study began to solicit willing participants before the Research Ethics Review Committee of the college gave the research project its formal approval to gather data, the findings are invalid.
- C = Some women in the study over-reported their compliance with the eating and exercise regimen, which led the researchers to underestimate the full impact of the regimen.
- D = Since many of those studied described themselves as overweight or out of shape when the study began, a similar regimen will not benefit people who are healthier to start with.
- E = The performance tests used to evaluate the health and well-being of females may not be appropriate for evaluating the health and well-being of males.

**Sample Thinking Skills Question #3.**

Consider the claim, "Working with a teammate or partners on a health regimen is better than working individually." Which of the following additional pieces of information would not weaken that claim?

- A = Most of the women in the group that was encouraged to work individually actually worked with friends and partners who were not part of the study.
- B = Most of the pairings and teams created in the first group (with teammates) fell apart after a few days and the women in that group actually worked individually.
- C = There was something about the women in the first group (with teammates) that the researchers overlooked, thus invalidating the intended matching of the two groups.
- D = Men are more likely to work alone, so any recommendation that men find a teammate or partner to support them in sticking with the regimen will be ignored.
- E = The study was undertaken when there were no exams or major projects due, thus the results about working with a teammate do not apply to more stressful times of the year.

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