

MODELING AND SIMULATION IN THE ARMY  
INTERMEDIATE LEVEL EDUCATION  
CRITICAL THINKING CURRICULUM

A thesis presented to the Faculty of the U.S. Army  
Command and General Staff College in partial  
fulfillment of the requirements for the  
degree

MASTER OF MILITARY ART AND SCIENCE  
General Studies

by

KYLE MATTHEW YANOWSKI, MAJ, U.S. ARMY  
B.A., Sam Houston State University, Huntsville, Texas, 2004

Fort Leavenworth, Kansas  
2015

Approved for public release; distribution is unlimited.

<b>REPORT DOCUMENTATION PAGE</b>				<i>Form Approved</i> OMB No. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. <b>PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.</b>					
<b>1. REPORT DATE (DD-MM-YYYY)</b> 12-06-2015		<b>2. REPORT TYPE</b> Master's Thesis		<b>3. DATES COVERED (From - To)</b> AUG 2014 – JUNE 2015	
<b>4. TITLE AND SUBTITLE</b>  Modeling and Simulation in the Army Intermediate Level Education Critical Thinking Curriculum				<b>5a. CONTRACT NUMBER</b>	
				<b>5b. GRANT NUMBER</b>	
				<b>5c. PROGRAM ELEMENT NUMBER</b>	
<b>6. AUTHOR(S)</b>  Kyle M. Yanowski, Major				<b>5d. PROJECT NUMBER</b>	
				<b>5e. TASK NUMBER</b>	
				<b>5f. WORK UNIT NUMBER</b>	
<b>7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)</b> U.S. Army Command and General Staff College ATTN: ATZL-SWD-GD Fort Leavenworth, KS 66027-2301				<b>8. PERFORMING ORG REPORT NUMBER</b>	
<b>9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)</b>				<b>10. SPONSOR/MONITOR'S ACRONYM(S)</b>	
				<b>11. SPONSOR/MONITOR'S REPORT NUMBER(S)</b>	
<b>12. DISTRIBUTION / AVAILABILITY STATEMENT</b> Approved for Public Release; Distribution is Unlimited					
<b>13. SUPPLEMENTARY NOTES</b>					
<b>14. ABSTRACT</b>  The United States Army recognizes that critical thinking is a vital skill for United States Army Officers to master in order to adapt to the complex environments of today. The modern curriculum in Intermediate Level Education (ILE) offers a program of critical thinking courses designed to introduce military officers to the foundations of thinking critically. Although these courses are well received, the lessons utilize only a few mental models, and are lacking in more modern simulations that meet the need of a generation that is stimulated with multimedia. The purpose of this thesis is to examine how modeling and simulation can enhance the critical thinking curriculum in ILE. This study focuses solely on critical thinking lessons identified in the core curriculum of the Command and General Staff Operations Course (CGSOC). In addition, utilization of in-direct simulations, like Decisive Action ® and Eve Online ® can allow students to visualize and think critically about complex environments.					
<b>15. SUBJECT TERMS</b>  Critical Thinking, Simulations, MMO, Reasoning					
<b>16. SECURITY CLASSIFICATION OF:</b>			<b>17. LIMITATION OF ABSTRACT</b>	<b>18. NUMBER OF PAGES</b>	<b>19a. NAME OF RESPONSIBLE PERSON</b>
<b>a. REPORT</b>	<b>b. ABSTRACT</b>	<b>c. THIS PAGE</b>			<b>19b. PHONE NUMBER (include area code)</b>
(U)	(U)	(U)	(U)	75	

MASTER OF MILITARY ART AND SCIENCE

THESIS APPROVAL PAGE

Name of Candidate: Major Kyle M. Yanowski

Thesis Title: Modeling and Simulation in the Intermediate Level Education Critical Thinking Curriculum

Approved by:

\_\_\_\_\_, Thesis Committee Chair  
George Hodge, M.A.

\_\_\_\_\_, Member  
James Sterrett, Ph.D.

\_\_\_\_\_, Member  
Michael Weaver, M.A.

Accepted this 12th day of June 2015 by:

\_\_\_\_\_, Director, Graduate Degree Programs  
Robert F. Baumann, Ph.D.

The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

## ABSTRACT

MODELING AND SIMULATION IN THE INTERMEDIATE LEVEL EDUCATION CRITICAL THINKING CURRICULUM, by MAJ Kyle M. Yanowski, 75 pages.

The United States Army recognizes that critical thinking is a vital skill for United States Army Officers to master in order to adapt to the complex environments of today. The modern curriculum in Intermediate Level Education (ILE) offers a program of critical thinking courses designed to introduce military officers to the foundations of thinking critically. Although these courses are well received, the lessons utilize only a few mental models, and are lacking in more modern simulations that meet the need of a generation that is stimulated with multimedia. The purpose of this thesis is to examine how modeling and simulation can enhance the critical thinking curriculum in ILE. This study focuses solely on critical thinking lessons identified in the core curriculum of the Command and General Staff Operations Course (CGSOC). In addition, utilization of in-direct simulations, like Decisive Action ® and Eve Online ® can allow students to visualize and think critically about complex environments.

## ACKNOWLEDGMENTS

This thesis is a direct result of my experience in Intermediate Level Education. This thesis is not critical of the school, the college, or the faculty in any way, shape or form; the school is very good at what it does: educating the next generation of Field Grade officers.

I would like to thank my fellow students, who managed to entertain my contrarian points of view (all of the time) and bring me back to reality when I become too technical. These characteristics also apply to the MMAS board that guided me in researching this paper. Additionally, I would like to thank Dan Eastwood, who helped in understanding the statistics in my research.

Most of all, I would like to thank my family. My wife Trisha, the amazing woman who urged me onward when I faltered in researching, supported me, raised our child, and built a successful business from the ground up. My son Jack, who has a knack for telling jokes that not only made me laugh, but also inspired me to think critically throughout the entire duration of this research. I thank them both for everything.

# TABLE OF CONTENTS

	Page
MASTER OF MILITARY ART AND SCIENCE THESIS APPROVAL PAGE .....	iii
ABSTRACT.....	iv
ACKNOWLEDGMENTS .....	v
TABLE OF CONTENTS.....	vi
ACRONYMS.....	viii
ILLUSTRATIONS .....	ix
TABLES .....	x
CHAPTER 1 INTRODUCTION AND OVERVIEW .....	1
Importance .....	2
The Research Question .....	2
The Data Collection Plan .....	5
Conclusion .....	7
CHAPTER 2 REVIEW OF LITERATURE .....	8
Section I: Introduction .....	8
Section II Definitions .....	9
Section III: The Importance of Critical Thinking .....	12
Section IV: The CGSC Curriculum .....	16
Section V: Modeling and Simulation Enhanced Lessons .....	17
CHAPTER 3 RESEARCH METHODOLOGY .....	23
CHAPTER 4 ANALYSIS.....	29
Section I: Introduction .....	29
Section II Critical Thinking .....	30
Section III: Command and General Staff Curriculum .....	34
Section IV: Simulation Enhanced Critical Thinking .....	42
Section V: Conclusion .....	54
CHAPTER 5 CONCLUSIONS AND RECOMMENDATIONS .....	56
Section I: Introduction .....	56
Section II: Direct Simulation .....	57

Section III: Indirect Simulation Methods.....	58
Section IV: Conclusion .....	60
BIBLIOGRAPHY .....	63

## ACRONYMS

ADM	Army Design Methodology
ARTEP	Army Training and Evaluation Program
CGSC	Command and General Staff College
CGSS	Command and General Staff School
DA	Decisive Action ®
EVE	Eve Online ®
MDMP	Military Decision Making Process
RDMP	Rapid Decision Making Process

## ILLUSTRATIONS

	Page
Figure 1. Maggart’s Road Ahead Model.....	18
Figure 2. Elements of Thought Model .....	35
Figure 3. Intellectual Standards Model .....	37
Figure 4. Intellectual Traits Model.....	38
Figure 5. Critical Thinking Relationships .....	39
Figure 6. Guidelines for CT2 Development.....	44
Figure 7. In Game Screen Shot .....	51
Figure 8. In Game Screenshot .....	53

## TABLES

	Page
Table 1. CT2 Experiment Findings.....	46

## CHAPTER 1

### INTRODUCTION AND OVERVIEW

Responsibility to yourself means refusing to let others do your thinking, talking, and naming for you; it means learning to respect and use your own brains and instincts; hence, grappling with hard work.<sup>1</sup>

— Adrienne Richards

The United States Army is facing a more complex environment in the 21st century than any other time in its history. As the battlefield continues to evolve, as enemies continue to blend into the population and continue to affect the world as actors without borders, commanders will continue to demand that their subordinate leaders at all levels have the critical thinking skills required to frame the problems that plague the modern operational environment. Most often, Army officers, under stress and under compressed timelines, are deployed to hostile areas in noncontiguous environments and are expected to think critically and make reasonable decisions that impact hundreds, if not, thousands of lives. The reason, or rationalization, or ideally, the critical thinking demanded of these officers, is an acquired skillset that is largely uncultivated in American society, let alone the United States Army.<sup>2</sup> Furthermore, the critical thinking training that currently exists within the Army is usually devoid of any electronic multi-media and is often paired with an overly complex color picture of a mental model. The critical thinking curriculum

---

<sup>1</sup> ProCon.org, “Critical Thinking Quote: Adrienne Rich,” last updated August 8, 2013, accessed October 10, 2014, <http://www.procon.org/view.background-resource.php?resourceID=005392>.

<sup>2</sup> Richard Paul, Linda Elder, and Ted Bartell, 1997 Study of 38 public universities and 28 private universities to determine faculty emphasis on critical thinking in instruction.

available to officers consists of assigned reading without practical application. The majority of United States Officers were raised in a classroom environment that took advantage of technology and simulations to aid in education. Sadly, once they reach the Intermediate Level Education (ILE), technology is limited for applications other than critical thinking, if it is utilized at all. Since Army officers must reason through complex problem sets requiring critical thinking, it would be prudent to teach them critical thinking lessons enhanced by simulation that will assist in developing these skills.

### Importance

Critical Thinking in the United States Army is not a new research topic. There have been many studies written on the subject. Furthermore, there are numerous studies and articles written on utilizing modeling and simulation to enhance lessons in a classroom environment outside of Intermediate Level Education. This thesis is important because it bridges the gap between these two topics. Taking the current Intermediate Level Education critical thinking curriculum within the Army Intermediate Level Education and exploring and applying successful application of modeling and simulation inside and outside of ILE may be valuable to Army educators, commanders, and staff officers that require critical thinking skills.

### The Research Question

This thesis draws from a broad range of sources and material on the subject of critical thinking, as well as modeling and simulation, but narrows the scope of both by focusing on Intermediate Level Education. The primary research question is:

How can modeling and simulation enhance critical thinking skills taught in Intermediate Level Education?

In order to answer the primary research question, this paper will explore four related sub questions:

1. Why is it important to have critical thinking skills in Intermediate Level Education?
2. How are critical thinking lessons currently being taught in Intermediate Level Education?
3. How have simulations enhanced critical thinking lessons outside of Intermediate Level Education?
4. How can simulation enhanced critical thinking lessons be added to the Intermediate Level Education critical thinking curriculum?

The initial secondary research question, “Why is it important to have critical thinking skills in Intermediate Level Education?” will seek to overturn bias in the United States Army. Establishing the need for critical thinking skills in the Army will guide a reader to understand that being a member of the United States Army consists of more than “just following orders.” From a Battalion Commander all the way down to a M249 SAW Gunner pulling security, hard decisions are being made every day, in and out of combat, that affect the lives of the decision maker, those around the decision maker, and civilians in battle zones. It would also be a mistake to think that critical thinking rests only on the combat leader or the patrolman; critical thinking is also a paramount skill for the staff officer, removed from combat, who must think through complex problems before conflict

even starts. The Army, much like any organization, needs its members to be exceptional critical thinkers.<sup>3</sup> This requires critical thinking education and practice.

This leads to the next sub research question, “How are these lessons currently being taught in Intermediate Level Education?” Research on this question explores the current ILE curriculum, to whom the lessons are directed, and how the lessons are being received. Although the research is primarily focused on Intermediate Level Education, it is important to differentiate between the different levels of education within the United States Army. Within United States Army education, there exists early, intermediate, and advanced levels signified by respective schools. Early education consists of an Officer Basic Course program. For example, a 2nd Lieutenant Infantry officer will attend a multi-week basic course at Fort Benning Georgia. Intermediate Level Education occurs around the 10-year mark in an officer's career and is represented by the Army's Intermediate Level Education. Lastly, advanced education is usually reserved for the rank of Lieutenant Colonel (O-5) and Colonel (O-6) and is represented by the War College in Carlisle Barracks, Pennsylvania. This research will focus on ILE.

Exploring just the ILE curriculum of critical thinking skills would be folly without also exploring what lessons are available outside of the Fort Leavenworth campus; the critical thinking world is vast, and there are many lessons to be learned outside of an Army centric view. The next focused research question this paper will answer is “How have simulations enhanced critical thinking skills outside of the Command and General Staff curriculum?” Organizations both inside and outside of the United States Army have

---

<sup>3</sup> Smartwar.org, “Ray Odierno’s Reading List,” accessed September 6, 2014, <http://www.smartwar.org/reading-list/ray-odierno/>.

embraced visual learning to teach the millennial generation, to include using simulations to enhance understanding of critical thinking lessons. Researching the effective use of models and simulations in education environments will establish precedents that can be applied internally to the Army. This focal area also includes the conceptual use of modeling and simulation.

Finally, as further research unveils successful implementation of simulation into critical thinking lessons, it will also be important to answer the question “How can we transfer successful use of simulations in critical thinking into Intermediate Level Education?” This research focus area will determine the cost of specific programs, lessons, and simulations that would be suitable to augment the current ILE Curriculum.

#### The Data Collection Plan

All data was collected through resources on Fort Leavenworth, including works from the Combined Arms Research Library (CARL), Digital Leader Development Center (DLDC) in the Command and General Staff College, and program curricula from the various Centers of Excellence of the Combined Arms Center.

The Combined Arms Research Library was be the primary means of data collection through works on the subjects of critical thinking, teaching of critical thinking skills, and applied critical thinking in the United States Army. Further, CARL provided examples of past MMAS research theses that aided in the format and construction of this paper.

The primary simulation utilized in data collection was Decisive Action ®. This constructive simulation was designed by a former Command and General Staff College faculty member and is used during the Advanced Operations Course of the CGSOC

curriculum. Additionally, the multiplayer online game Eve Online ® is also a focus for this thesis. Eve Online ® is developed by CCP games based out of Iceland. Although there is very little formal academic research conducted on Eve Online ®, most research on the game will be through hands on interaction by the author.

Lastly, in order to determine if gaps in training currently exist, the Combined Arms Center resources on post had the various curriculums, past and present, and any material or simulations utilized to enhance or teach critical thinking lessons.

The author observed that even though simulations were utilized in ILE, some staff group instructors embraced the simulation more than others. Some instructors were also observed to be more comfortable with the use of simulations than others. This raised the question as to whether or not instructor “buy in” was a determining factor in the successful implementation of simulation in any lesson, critical thinking lessons included. Ultimately this question became a delimitation for this thesis, as the topic requires extensive research that exceeded the amount of time allotted for this thesis. This delimitation is further addressed in chapter 5.

Time was a limitation for this thesis. The requirements of the school often did not aid in the specific research topics of this MMAS thesis. Further, the time requirement to research, draft, and defend this thesis had to be complete in less than a year. The time resourced for both class requirements and research has had compounding limiting effects on the writing of this thesis. As an example, the use of surveys in researching the effectiveness of the current CGSC critical thinking curriculum, or using quantitative measurements of critical thinking GPA among ILE students were passed over in favor of the assumption that current lessons were effective in instilling critical thinking skills in

student officers. The result is that there is very little quantitative data to support the conclusions listed in chapter 5. Lastly, because of the requirements of class and family, the author was unable to travel to any locations outside of a radius of 400 miles from Fort Leavenworth.

### Conclusion

This thesis encompasses a qualitative study on the question “How can modeling and simulation enhance critical thinking skills taught in Intermediate Level Education”. It answered this question by exploring a series of related sub questions: Why is it important to have critical thinking skills in Intermediate Level Education? How does ILE teach critical thinking? How have simulations enhanced these skills outside of Intermediate Level Education? Finally, how can we add enhanced critical thinking lessons to Intermediate Level Education? All research conducted to answer these questions was confined to Fort Leavenworth, Kansas, and any pertinent areas located in a 400 mile radius from Fort Leavenworth. Research material included material from the Combined Arms Research Library, DLDC in the Command and General Staff College, the Combined Arms Center, and Centers of Excellence resources. Time was ultimately the limiting factor in the research for this topic.

CHAPTER 2  
REVIEW OF LITERATURE

I challenge each of you to tackle these books and improve your power of critical thinking and understanding of the profession of arms.<sup>4</sup>

— Raymond Odierno

Section I: Introduction

This chapter is a comprehensive review of the definition of critical thinking and why it is an important learning topic for the United States Army, of the current state of critical thinking lessons within the United States Army Command and General Staff College, and finally, of how modeling and simulation can enhance the current curriculum in Intermediate Level Education. This chapter focuses on a primary research question and four related sub questions.

Primary Research Question: How can modeling and simulation enhance critical thinking skills taught in Intermediate Level Education?

Secondary Research Question One: Why is it important to have critical thinking skills in Intermediate Level Education?

Secondary Research Question Two: How are these skills currently being taught in Intermediate Level Education?

Secondary Research Question Three: How have simulations enhanced these skills in organizations outside of Intermediate Level Education?

---

<sup>4</sup> Smartwar.org, “Ray Odierno’s Reading List,” accessed September 6, 2014, <http://www.smartwar.org/reading-list/ray-odierno/>.

Secondary Research Question Four: How can we transfer successful enhanced critical thinking lessons into Intermediate Level Education critical thinking curriculum?

The primary research question and the four related sub questions are designed to illuminate the current state of critical thinking in Intermediate Level Education curriculum, where the curriculum is required to be in the future, and how modeling and simulation can get it there. The importance of this research is evident in the scope and quantity of works that not only highlight the importance of analog forms of critical thinking and training, but also works that marry traditional methods of critical thinking with computer simulations. In all, the majority of leaders in the fields of critical thinking theory and simulation education unconditionally agree on the importance of both fields in regards to humanity, and by proxy, the United States Army.

## Section II Definitions

Although this thesis is written for a military audience with a shared understanding of military terms and language, it is important to broaden the scope and ensure all terms are clearly defined. The following definitions are understood in both the United States Army, the Modeling and Simulation community, and the gaming community.

Cognitive Bias: is a pattern of deviation in judgment that occurs in particular situations. Implicit in the concept of a "pattern of deviation" is a standard of comparison; this may be the judgment of people outside those particular situations, or may be a set of independently verifiable facts.<sup>5</sup>

---

<sup>5</sup> Princeton.edu, "Cognitive Bias," accessed May 10, 2015, [http://www.princeton.edu/~achaney/tmve/wiki100k/docs/Cognitive\\_bias.html](http://www.princeton.edu/~achaney/tmve/wiki100k/docs/Cognitive_bias.html).

Command and General Staff College: the Command and General Staff College consists of four schools, the largest of which is the Command and General Staff School (CGSS), and it is CGSS which teaches the Command and General Staff Officers' Course that all US Army majors attend, either at Fort Leavenworth or at one of four satellite locations.<sup>6</sup>

Creative Thinking: is the generation of new ideas within or across domains of knowledge, drawing upon or intentionally breaking with established symbolic rules and procedures. It usually involves the behaviors of preparation, incubation, insight, evaluation, elaboration, and communication.<sup>7</sup>

Critical Thinking: is the active, persistent, and careful consideration of a belief or form of knowledge, the grounds that support it, and the conclusions that follow. It involves analyzing and evaluating one's own thinking and that of others. In the context of college teaching and learning, critical thinking deliberately and actively engages students in bringing together existing ideas into new configurations, developing new properties or possibilities for something that already exists, and discovering or imagining something entirely new.<sup>8</sup>

---

<sup>6</sup> United States Army Combined Arms Center, "Command and General Staff College (CGSS)," accessed May 5, 2015, <http://usacac.army.mil/organizations/cace/cgsc/cgss>.

<sup>7</sup> NC State University, "Critical and Creative Thinking Definition," accessed October 10, 2014, <http://accreditation.ncsu.edu/critical-creative-thinking-definitions>.

<sup>8</sup> Ibid.

Decisive Action ®: is a constructive simulation developed by Decisive Games that uses a force on force aggregated model to drive staff training events in Intermediate Level Education.<sup>9</sup>

Eve Online ®: is a persistent, single server, massively multiplayer online role playing game that is set in space in the distant future where players are encouraged to form alliances and wage war for control of resources, markets, trade routes, and territory.<sup>10</sup>

Intermediate Level Education: ILE consists of two components, the Command and General Staff Officer Course (CGSOC) Common Core Course, and the Advanced Operations Course that is the credentialing source for field grade officers in the operational Army. Students complete these courses in an experiential learning environment that yields adaptive, self-aware, field grade leaders of character and competence who are capable of shaping the joint operational environment.<sup>11</sup>

Logical Fallacy: A flaw in reasoning.<sup>12</sup>

---

<sup>9</sup> Decisive-Point, “What’s a Serious Game,” accessed May 10, 2015, <http://www.decisive-point.com/>.

<sup>10</sup> EVE Online, EVE Online Is a Massive Multiplayer Online Roleplaying Space Game, accessed May 10, 2015, <https://www.eveonline.com/>.

<sup>11</sup> United States Army Combined Arms Center, “CGSC Intermediate Level Education,” accessed February 10, 2015, <http://www.cgsc.edu/ile/summary.asp>.

<sup>12</sup> Your Logical Fallacies, “Thou Shalt Not Commit Logical Fallacies,” accessed January 17, 2015, <https://yourlogicalfallacyis.com/>.

Model: A physical, mathematical, or otherwise logical representation of a system, entity, phenomenon, or process.<sup>13</sup>

Simulation: A method for implementing a model over time.<sup>14</sup>

### Section III: The Importance of Critical Thinking

The first critical piece of literature review focuses primarily on the aspect of what critical thinking is and why critical thinking is important in the United States Military. This topic is important because it provides a common understanding for the complex definition of critical thinking. It also establishes why critical thinking is important for the Army as an organization, as well as individual officers.

In 1998, Peter A. Facione wrote an article titled “Critical Thinking: What It Is and Why It Counts.” He did not present a single definition of critical thinking to the reader in order to illustrate that critical thinking, or good thinking, is a process with multiple approaches and not something to just be “memorized.”<sup>15</sup> Critical thinking, as defined in the North Carolina State University aggregation earlier in this chapter, is a careful consideration of knowledge, asking questions, and using reason and logic in order to form conclusions about complex problems. Likewise, the definition is further expanded in Richard Paul’s and Linda Elder’s work, “Critical Thinking Concepts and Tools” where

---

<sup>13</sup> Ibid.

<sup>14</sup> Department of the Army, Army Regulation (AR) 5-11, *Management of Army Modeling and Simulation* (Washington, DC: Government Printing Office, 2014).

<sup>15</sup> Peter A. Facione, *Critical Thinking: What It Is and Why It Counts* (Millbrae, CA: California Academic Press, 1998).

critical thinking is defined as “an art of evaluating thought with a view on improving it.”<sup>16</sup> Whatever definition or lack thereof is used, critical thinking is the process of analysis, evaluation, and synthesis of the complex problems in everyday life. A common theme among the previously mentioned works is that critical thinking is also a skill that must be developed, cultivated, and practiced. Facione elaborates on idea by identifying six core critical thinking skills.<sup>17</sup>

1. Analysis: “to identify the intended and actual inferential relationships among statements, questions, concepts, descriptions, or other forms of representation intended to express belief, judgement, experiences, reasons, information, or opinions.”<sup>18</sup>
2. Inference: “to identify and secure elements needed to draw reasonable conclusions; to form conjecture and hypotheses; to consider relevant information and to deduce the consequences flowing from data, statements, principles, evidence, judgements, beliefs, opinions, concepts, descriptions, questions, or other forms of representation.”<sup>19</sup>
3. Explanation: “being able to present in a cogent and coherent way the results of one’s reasoning.”

---

<sup>16</sup> Richard Paul and Linda Elder, *The Miniature Guide to Critical Thinking: Concepts and Tools*, 6th ed. (Dillon Beach, CA: Foundation for Critical Thinking, 2009).

<sup>17</sup> Facione, *Critical Thinking*.

<sup>18</sup> *Ibid.*

<sup>19</sup> *Ibid.*

4. Evaluation: “to assess the credibility of statements or other representations which are accounts or descriptions of a person’s perception, experience, situation, judgement, belief, or opinion; and to assess the logical strength of the actual or intended inferential relationships among statements, descriptions, questions or other forms of representation.”<sup>20</sup>
5. Self Regulation: “to self consciously monitor one’s cognitive activities, the elements used in those activities, the results deduced, particularly by applying skills in analysis, and evaluation to one’s own inferential judgements with a view toward questioning, confirming, validating, or correcting either one’s reasoning or results.”<sup>21</sup>
6. Interpretation: “to comprehend and express the meaning or significance of a wide variety of experiences, situations, data, events, judgements, or criteria.”<sup>22</sup>

Peter Facione’s core critical thinking skills lay a framework, or baseline for the skills needed to carry on constructive discussion and research in both academic and professional fields. So paramount are these skills in the field of critical thinking, or even academia in general, that they are replicated in the elements of thought that are prevalent in the works of many experts in the field.

After reviewing literature on critical thinking and the skills required to do so, it is important to research the significance that critical thinking has within the United States Army. In “Critical Thinking for the Military Professional”, Colonel W. Michael Guillot

---

<sup>20</sup> Ibid.

<sup>21</sup> Ibid.

<sup>22</sup> Ibid.

cannot imagine a strategic thinker within the United States Army that lacks the thinking skills that allow him or her to master the strategic environment.<sup>23</sup> A common theme in Guillot's work is that critical thinking is not a skill alone, but also an attitude that is required of officers when working on a staff at any echelon. Commanders demand that incoming field grade officers are tactically and technically competent within their respective fields, and able to take unfamiliar and complex problem sets, think through them reasonably, and provide a myriad of solutions so that decisions can be made. Critical thinking is integral to every aspect of the officer's work. As an example, the Army utilizes a decision making process called the Military Decision Making Process, or MDMP. This process requires staff officers to work through difficult problem sets, critically think through the analysis of the problem sets, then reason and synthesize solutions to present to a commander.<sup>24</sup> ADM requires a staff, to critically think about a problem prior to MDMP, frame the problem, and then begin the process of analysis and synthesis of solution sets. The standardized processes provide a framework for both officers and staffs to critically think.

Critical thinking, using any of the definitions prescribed by Guillot, Paul, or Facione, is deeply embedded in the processes and culture of the United States Army. Through the Military Decision Making Process and Army Design Methodology, commanders at any echelon in the Army require staff officers to think critically about

---

<sup>23</sup> W. Michael Guillot, "Critical Thinking for the Military Professional," *Air and Space Power Journal* (2004).

<sup>24</sup> Anna Grome, Beth Crandall, Louise Rasmussen, and Heather Wolters, *Army Design Methodology: Commander's Resource* (Arlington VA: Army Research Institute for the Behavioral and Social Science, February 2012).

complex problems in a complex world. With the Army's renewed emphasis on Mission Command Philosophy, a philosophy that requires subordinates to make decisions based on initiative, the entire system of decision making with the United States Army inherently requires the leaders within its ranks to think critically, else operations big or small, will be at least inefficient and at worst, doomed to failure. The Chief of Staff of the United States Army, General Raymond Odierno has made the development of leaders his number one priority. Although means many things, a common theme that validates the importance of the field of critical thinking in the United States Army, is the repeated insistence of developing critical thinking skills among all leaders within the organization. In a recent interview, General Odierno stated "snap decision making calls for highly developed critical thinking skills—making informed and effective decisions in the midst of chaos, decisions that might one moment be military in nature and diplomatic the next."<sup>25</sup>

#### Section IV: The CGSC Curriculum

The initial lessons of Intermediate Level Education focus on establishing a new, critical thinking based paradigm for students. The CGSOC Common Core curriculum consists of eight hours of foundation critical thinking lessons divided into four classes. The four classes are listed below:<sup>26</sup>

1. C121 Introduction to Critical Thinking
2. C122 Critical and Creative Thinking

---

<sup>25</sup> David Vergun, "Odierno: Leader Development No. 1 Priority," The Official Homepage of the United States Army, accessed May 10, 2015, [http://www.army.mil/article/120024/OdiernoLeader\\_development\\_No1\\_priority/](http://www.army.mil/article/120024/OdiernoLeader_development_No1_priority/).

<sup>26</sup> Command and General Staff College, C120, "Critical and Creative Thinking," Advance Sheet, Syllabus for Academic Year 15, Fort Leavenworth, May 10, 2015.

3. C123 Diagnosing Impediments to Critical and Creative
4. C124 Application of Critical and Creative Thinking

C121, Introduction to Critical Thinking introduces the CGSC student to the basic concepts and definitions of critical thinking; the lesson introduces theorists in the field, like Facione, Elder and Paul, and builds upon the question of whether or not critical thinking is an important skill for use in the American Military. C122, Critical and Creative thinking builds upon the foundation of the C121 lesson by introducing Paul and Elder's "The Miniature Guide to Critical Thinking: Concepts and Tools" as a visual guide for students to grasp the definition of critical thinking, the elements of thought, and the universal intellectual standards. This lesson uses Paul's and Elder's guide to enhance the understanding; the guide consists of mental models only; no simulation is utilized. C123, Diagnosing Impediments to critical and creative thinking is an introduction to cognitive bias and logical fallacy. This lesson builds upon material learned earlier in the course and focuses on identifying common barriers to critical thought. The C120 block of instruction is concluded with C124, Application of Critical and Creative Thinking. Students are introduced to a case study based on a crisis in the Gaza strip and given an opportunity to identify logical fallacy and cognitive bias used in the study, and then are allowed the opportunity to apply the critical thinking skills developed in previous lessons.<sup>27</sup>

#### Section V: Modeling and Simulation Enhanced Lessons

During the summer of 2000, the United States Army held a conference in Fort Leavenworth, Kansas on the subject of critical thinking in the 21st century. Major

---

<sup>27</sup> Ibid.

General (Retired) Lon E. Maggart was invited as the keynote speaker to lend his thoughts on the subject. Published in 2001, Maggart's speech presented a simple mental model for training the officers in critical thinking skills. The model is presented in figure 1.

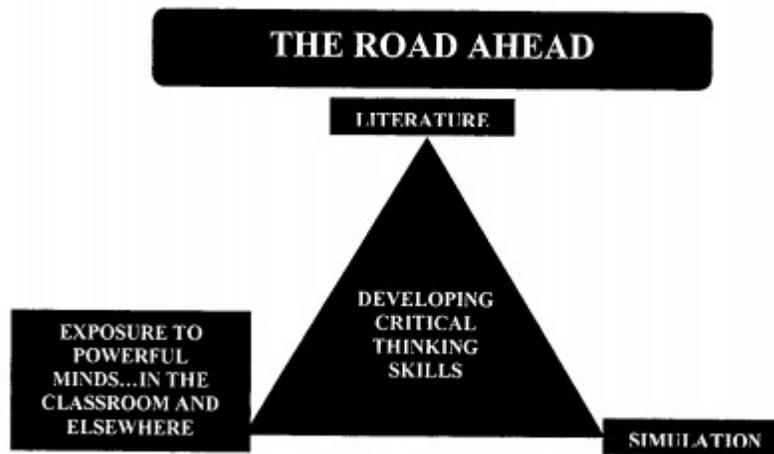


Figure 1. Maggart's Road Ahead Model

*Source:* Lon E. Maggart, "Critical Thinking in the 21st Century" (Lecture, Training Critical Thinking Skills for Battle Command: ARI Workshop from U.S. Army Research Institute for the Behavioral and Social Sciences, Fort Leavenworth, July 1, 2001).

Maggart's model represents three key aspects to inculcating, developing, and training critical thinking skills in the Army. At the top of the triangle, literature was represented as a pinnacle for developing critical thinking skills.<sup>28</sup> Literature, as represented in the model, relates closely with the common Army training pillar of self development. Maggart is quick to point out that reading literature that attempts to distill

---

<sup>28</sup> Lon E. Maggart, "Critical Thinking in the 21st Century" (Lecture, Training Critical Thinking Skills for Battle Command: ARI Workshop from U.S. Army Research Institute for the Behavioral and Social Sciences, Fort Leavenworth, July 1, 2001).

the definition of critical thinking down to a raw algorithm is not the goal, rather to read texts and articles that capture the essence of critical and original thought. On the left side of figure 1, Maggart recognized that exposure to powerful minds within the classroom and elsewhere is an important aspect for budding critical thinkers to test to test their ideas. Maggart references the use of the “excelnet” in the 1980s, which was essentially a forerunner to bulletin boards, chat rooms, and forums. The examples cited in excelnet were lessons learned opportunities that allowed users to share ideas and speak candidly (without impunity) about tactics and doctrine over long distances. Before the modern internet, the excelnet integrated geographically isolated people to ideas and concepts that would yield proven results in simulated environments such as the National Training Center. This forum exposed the practicing critical thinker to divergent methods of thinking. Lastly, on the right of figure 1, Maggart recognized that simulation is a key method for developing critical thinking skills. Maggart talks about being able to develop a common ground for critical thinkers in the Army to test their ideas and original thought. He cites that any simulation used must strike a balance between ease of use and availability. Specifically, Maggart talked about modifying a constructive simulation called JANUS, and making it available over existing Army networks. Maggart then highlights that “the bottom line is that simulations that permit out of the box thinking and experimentation must be accessible to all who have an interest in engaging in [critical thinking].”<sup>29</sup> In the following paragraph, Maggart describes the effects of simulations on critical thinking within the Army after having his students use a simulation to develop a brigade attack course of action.

---

<sup>29</sup> Ibid.

We derived a number of compelling insights into how battles could be fought if a unit was equipped in a very specific way. This excursion allowed us to critically think about future operations in ways that would have never been possible by conjuring in a classroom. And we did so in the course of an afternoon, not after weeks of intellectual exploration. Curiously, it occurred to me that this was precisely the way we should be establishing our acquisition requirements documents and evaluating operations and organization concepts as well. It was also one of my earliest insights to the power of using simulations to promote critical thinking.<sup>30</sup>

Where Maggart covers the broad range of effects of critical thinking training in United States Army, Susan Fischer and her team's work on "Computerized Training in Critical Thinking" present a more direct approach to enhancing critical thinking skills in the classroom. Although Fischer's research originally set forth to meet a requirement to develop a distance learning tool to develop critical thinking skills in the United States Army, her team ultimately came to the conclusion that critical thinking skills can be enhanced by utilizing web based, modular, programs, that can be local, or distance based. Her work is encapsulated in two specific reports, "Computerized Training in Critical Thinking"<sup>31</sup> and a more broad research thesis "Critical Thinking Training for Army Officers"<sup>32</sup> both works refer to the use of simulation enhanced critical thinking lessons, and both works largely echo the principles of critical thinking held by experts in the field such as Facione, Elder, and Paul. Susan Fischer's work with computerized training in critical thinking is discussed at length in chapter 4, under the topic of direct simulation methods.

---

<sup>30</sup> Ibid.

<sup>31</sup> Susan C. Fischer, *Computerized Training in Critical Thinking (CT)<sup>2</sup>: A Skill-Based Program for Army Personnel* (Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences, 2009).

<sup>32</sup> Ibid.

Lastly, there is one additional area to cover concerning the online massive multiplayer online video game, Eve Online ®. Eve Online ® is a persistent, sandbox type universe developed and maintained by the Icelandic company CCP games. The sandbox nature of Eve Online ®, referring to a chaotic “find your own way” model, stimulates players to form nations, alliances, and coalitions in order to wage warfare against other players from around the world in order to control resources and markets in a persistent universe. Social Groups within the digital game world and the conflict between those groups, very closely mirror the same strategic, operational, and tactical levels of conflict that exist in the real world. Operational variables such as political, military, economic, and social, among others, are used by players in the game to understand the environment and gain leverage over friend and foe alike. The author has been a consistent contributor to the game since 2011 and manages an online fan website about the game as well as a popular Eve Online ® podcast titled “High Drag.”<sup>33</sup> There is no research that has been conducted on the effective use of Eve Online on enhancing critical thinking lessons in any type of classroom environment, nor could any academic research be found on the game outside of the game’s network architecture. However, the author’s direct experience with the game over a four year period has led him to conclude that Eve Online ® is a simulation that closely reflects realistic environments, the same environments that are studied closely by CGSOC students, just in an alternative setting. Because of this combination of a realistic physical and social environments and setting change, Eve Online ® might have an effect of breaking anchors, along with other cognitive bias and

---

<sup>33</sup> High Drag, “An Eve Online Podcast and Blog,” accessed May 10, 2015, <https://highdrag.wordpress.com>.

logical fallacy in CGSOC lessons where critical thinking is required. Eve Online® is discussed in chapter 4 of this thesis, in the “indirect” simulation methods section.

CHAPTER 3  
RESEARCH METHODOLOGY

Learning by doing, peer-to-peer teaching, and computer simulation are all part of the same equation.<sup>34</sup>

— Nicholas Negraponte

As indicated in chapter 2, critical thinking is one of the most important skills for leaders in the United States Army to develop in the 21st century. Critical thinking is not a subject that can be boiled down and memorized as an algorithm, rather a way of logical thinking that must be taught and then practiced throughout the practitioner's lifetime. In the same manner that a reasonable conclusion flows from a logical argument, the methodology utilized during this research attempted to follow the same reasonable approach emphasized in academic circles within the field of critical thinking.

All of the research conducted in this thesis is qualitative in nature. The following research steps were taken:

1. identifying the current need for critical thinking in the Command and General Staff School,
2. identifying current gaps in the current Intermediate Level Education critical thinking curriculum, and
3. applying modeling simulations to enhance critical thinking understanding in the Intermediate Level Education environment.

---

<sup>34</sup> BrainyQuote, "Simulation Quotes," accessed May 10, 2015, <http://www.brainyquote.com/quotes/keywords/simulation.html>.

These three areas are a distilled rendering of the original 5 research questions presented in chapter 1 and chapter 2 of this thesis.

In order to find the answers in these areas, and by proxy, the original research questions, it was important to establish a baseline for the definition of critical thinking by researching authors within the United States Army as well as authors that are not necessarily associated with the United States Army, but are still considered experts in their given field and theory. This approach was utilized to ensure that the military definition of critical thinking did not vary too greatly from the definitions used by scholars in the same field. Often, the Military can adapt definitions that are common in other professional fields, only to turn around and alter the definition to fit into a larger military paradigm. The variations in the official Department of Defense definition of “Terrorism” and that of The United States Army is a prime example of this occurrence. The required research for this area was available in reasonable quantities in the Fort Leavenworth Combined Arms Research Library, and indeed, the baselines between the Army, ILE, and academic critical thinking field were similar. Ultimately, this research question is answered by comparing the definitions established by Paul and Elders, Facione, and that which is presented in the ILE curriculum.

The current teaching curriculum at the Command and General Staff College was readily available from the course syllabus and lesson plans provided on the Blackboard® site for the college. There were opportunities to interview the faculty of ILE about the critical thinking curriculum within the school. However, the ILE organization is largely process driven, and it was assumed that few faculty members deviate from the prescribed lesson plans. Interviews were passed over in favor of information readily available in the

form of lesson plans and the ILE critical thinking course syllabus. No deviations in the ILE critical thinking curriculum were observed by the author. This established rule, allowed the scope of the research to remain narrow enough to be analyzed in the time given for the thesis completion. Likewise, there were opportunities to survey students who have received critical thinking training from the college; however, a survey in this field of the research was passed over due to time constraints and the already established fact that direct simulation is simply not used within the critical thinking curriculum. The purpose of this research is not to determine the efficacy of the current curriculum, rather, whether or not the current curriculum can benefit from simulation in passing critical thinking skills to student officers.

The final portion of research focuses on areas of the field where simulation has successfully enhanced any critical thinking lessons in the classroom environment. This area is approached in two ways. First, it was assumed that at some point in history, simulations were used to directly enhance a student's understanding of critical thinking theory. These simulations were assumed to be built for teaching recognition of cognitive bias or logical fallacy (direct simulation). Unfortunately, the majority of these programs exist as text based apps for portable media devices and were passed over as digital page turning. There was a single exception that was grouped into the direct simulation category which offered an alternative to the "chocolate-covered" digital textbooks that were readily available. The author researched Susan Fischer's work on Computerized Training in Critical Thinking (CT2) to understand if critical thinking skills could be taught directly through repetitive simulation.

The second approach to this question focused on simulations that indirectly enhanced or reinforced critical thinking lessons in the classroom outside of the original core critical thinking classes. There were multiple sources that expressly studied the efficacy of simulations indirectly enhancing critical thinking skills. In addition, several simulations were made available by the Command and General Staff School's DLDC department. Due to the resources available in the college, simulations applicable to the field of critical thinking were available to set up and manipulate. The author researched Decisive Action ® to ascertain if DA could enhance critical thinking through the tactical problem sets of a constructive simulation. The Decisive Action ® simulation was used on multiple occasions and provided the author with hands on experience with a reasonable visualization of tactical problem sets that a division staff, as well as an ILE student would encounter. Decisive Action ® provided a resource for common tactical problems, but did not cover any requirement to think critically about abstract concepts like terrorist networks, terrorist attacks, or information operations; all of which are common problems that field grade officers are expected to think critically about.

Eve Online ® was researched because it simulates complex and abstract environments and organizations that are otherwise not simulated in ILE. Eve Online ® was grouped into the indirect simulation method approach, along with Decisive Action ® which fulfills requirements for inculcating critical thinking skills as presented by Maggart in the previous chapter. Eve Online ® is an important simulation to research in the critical thinking context, because its alien setting has the potential to break common military paradigms and anchors associated with the common scenarios replicated in the Intermediate Level Education classroom.

After researching these main areas of critical thinking and simulation, logical conclusions were formed about enhanced critical thinking lessons that would be applicable to the Intermediate Level Education core critical thinking curriculum. All of the data to support these conclusions was collected through resources on Fort Leavenworth, to include works from the Combined Arms Research Library (CARL), DLDC in the Command and General Staff College, and program curriculums from the various Centers of Excellence of the Combined Arms Center.

The Combined Arms Research Library (CARL) was the primary means of data collection through works on the subjects of critical thinking, teaching of critical thinking skills, and applied critical thinking in the United States Army. Further, CARL provided examples of past MMAS research theses that aided in the format and construction of this thesis.

The primary simulation utilized in data collection was Decisive Action®. Designed by a former Command and General Staff faculty member, DA is used during the Advanced Operations Course of the Intermediate Level Education curriculum. Decisive Action® is also a program to which the researcher has a significant amount of experience; first being introduced to the program through computer aided learning in the core curriculum of the Intermediate Level Education, then running the simulation for an exercise during the advanced operation course. The hands-on experience of operating a constructive simulation like Decisive Action ® provided a link between direct simulation methods, discussed in chapter 4, and the visualization where critical thinking reinforcement occurs. Likewise, Eve Online ® was used extensively throughout this thesis

to determine if the games organizations and environments would provide a beneficial visualization for ILE students to critically think about.

Lastly, in order to determine if gaps in training or education existed in the critical thinking curriculum, the Combined Arms Center resources on post provided the various curriculums, past and present, and any material or simulations utilized to enhance or teach critical thinking lessons.

Time was a limitation. Unlike many Masters programs, the Command and General Staff College advises students to complete their works in under a year. In addition, because of the requirements of class and family, the author was unable to travel to any locations outside of a radius of 400 miles from Fort Leavenworth.

In summary, the qualitative research required to form a reasonable conclusion about the primary research question was found in the Combined Arms Research Library and in the Command and General Staff College's own resources. The narrowed scope of research, coupled with the logical research question framework in this thesis, provided enough information for thorough analysis. After presenting this analysis in chapter 4, the findings and conclusions is presented in chapter 5.

## CHAPTER 4

### ANALYSIS

It is the mark of an educated mind to be able to entertain a thought without accepting it.

— Aristotle

#### Section I: Introduction

The qualitative research conducted during this study was centered on the question: “Can modeling and simulation enhance critical thinking skills taught in Intermediate Level Education?”

This chapter continues with the common framework developed in previous chapters by presenting the data in three sections. Section II presents the data and analysis on the importance of critical thinking to Intermediate Level Education. The analysis was built upon the definitions and literature review initiated in chapter 2 of this study. It is imperative to establish the importance of critical thinking in the military in order to understand the need for a robust curriculum on the subject in Intermediate Level Education. Section III of this chapter will present the data and analysis on the Intermediate Level Education critical thinking curriculum. Section III will focus on the specific core critical thinking lessons as well as any lessons that reaffirm critical thinking skills throughout the class year. Analyzing the Intermediate Level Education critical thinking curriculum is important in understanding if modeling and simulation can enhance what is already in place at the college. Section IV of this chapter will present the data and analysis of simulation-enhanced lessons in critical thinking. The data presented in section IV will cover simulation enhanced critical thinking lessons that were either

successfully implemented in classroom environments or could be potentially successful if implemented in ILE. The importance of analyzing successful implementation of simulations that enhance critical thinking lessons will directly answer the primary research question and establish if enhancing critical thinking lessons with simulations is also feasible in Intermediate Level Education.

## Section II Critical Thinking

A common theme and definition of critical thinking was established through multiple sources. Paul and Elder have distilled the definition down to a simple sentence “the art of analyzing and evaluating thinking with a view to improving it.”<sup>35</sup> While experts in the field of critical thinking theory, like Paul and Elder, are determined that a concept as important as critical thinking must be defined in the simplest of terms, others are determined to explore what critical thinking is not. This is evident in Michael Guillot’s work, “Critical Thinking for the Military Professional” where he proclaims, “To understand the concept of critical thinking, first one must try to define it—what it is and what it is not. Next, the prospective critical thinker must study the topic to develop critical thinking skills.”<sup>36</sup> Whether an expert in the field is defining critical thinking with a simple sentence, or going back to Ancient Greece to broaden the concept, the essence of critical thinking comes back to single word: Reason. The opposite of rationalization, reason, forces the thinker to form a conclusion based on the evidence at hand, whereas rationalization seeks evidence to support an already drawn conclusion. In other words,

---

<sup>35</sup> Paul and Elder, *The Miniature Guide to Critical Thinking*.

<sup>36</sup> Guillot, “Critical Thinking for the Military Professional.”

reason allows a conclusion to flow naturally from logically connected ideas. As indicated earlier in this thesis, the research into the field of critical thinking did not halt with the word “reason,” in many instances; the research emphasized the human aspect of critical thinking rather than focus on the action of reasoning. For instance, Paul and Elder spend a considerable amount of time and work describing what a human critical thinker is and what he or she can accomplish.

A well cultivated critical thinker: raises vital questions and problems, formulating them clearly and precisely; gathers and assesses relevant information, using abstract ideas to interpret it effectively; comes to well-reasoned conclusions and solutions, testing them against relevant criteria and standards; thinks open mindedly within alternative systems of thought, recognizing and assessing, as need be, their assumptions, implications, and practical consequences; and communicates effectively with others in figuring out solutions to complex problems.<sup>37</sup>

It would be remiss to address only the characteristics of a critical thinking and the action of reasoning without touching on other, more specific areas within the field of critical thought. There are, of course, other aspects in the critical thinking field that deal with cognitive bias and logical fallacy. As a misinformed definition is an obstacle to research, cognitive bias and logical fallacy are obstacles to reasonable conclusions.

Cognitive bias is defined as “a pattern of deviation in judgment, whereby inferences about other people and situations may be drawn in an illogical fashion.”<sup>38</sup>

Though many examples of cognitive bias are given, Dr. Steven Novella best describes cognitive bias using confirmation bias between a husband and wife. Early in his

---

<sup>37</sup> Paul and Elder, *The Miniature Guide to Critical Thinking*.

<sup>38</sup> Martie G. Haselton and Daniel Nettle, “The Paranoid Optimist: An Integrative Evolutionary Model of Cognitive Biases,” *Personality and Social Psychology Review* (2006): 47-66.

lectures, Dr. Novella paints the picture of a married couple who, being victims of confirmation bias, are convinced of each other's innocence and violation of leaving a toilet seat up after use. In the scenario, the wife's bias is confirmed due to a heightened sense of awareness when encountering a toilet seat that is "up." Because of her emotional state, her brain is prone to confirm events that are expected. Likewise, when the same toilet seat is encountered again, this time in the down position, the event is not part of confirmation, and is therefore dismissed.<sup>39</sup> The end result of this scenario, is the constant bickering of a married couple who are both somewhat correct and somewhat wrong. This type of scenario, with confirmation bias, can play out just as easily in the military arena as it can in the married household. It is not too farfetched to imagine a modern military commander falling victim to confirmation bias, just as General Custer did with the 7th Cavalry at Little Bighorn.<sup>40</sup>

Like cognitive bias, logical fallacy is also an important aspect of critical thinking to consider. Purdue University defines logical fallacy as "common errors in reasoning that will undermine the logic of your argument. Fallacies can be either illegitimate arguments or irrelevant points, and are often identified because they lack evidence that supports their claim."<sup>41</sup> There are hundreds of demonstrated logical fallacies that exist, many of which are used in everyday disagreements in the home, in business, and in the

---

<sup>39</sup> Your Deceptive Mind, Performed by Steven Novella, United States: The Great Courses [Audible], 2012, Audio Book.

<sup>40</sup> Some historians theorize that General Custer's conclusions about the size of the enemy force led him to see his plan in an intelligence picture that was not there.

<sup>41</sup> Purdue OWL, "Logical Fallacies," accessed March 17, 2015, <https://owl.english.purdue.edu/owl/resource/659/03/>.

United States Army. Logical fallacy, as defined by Purdue, “is an illogical attack on reasoning that ends conversation and halts critical thought.”<sup>42</sup> As an example of logical fallacy, an ad hominem attack can be examined behind the closed doors of a military leader’s office. If an officer with a dubious reputation presents a soundly reasoned idea, his argument can easily be dismissed with a swift attack on his character. This ad hominem logical fallacy seeks to dismiss reasoning through attacks on character.

Another example is the logical fallacy of appealing to authority, which dismisses reason by painting a character as infallible. “The Commander must be right, because he is in charge.” Although there are only two examples of logical fallacy that are presented in this paragraph, there are hundreds of examples of logical fallacy and cognitive bias that prevent critical thinking from taking place in organizations of all types.<sup>43</sup>

Defining critical thinking is ultimately the first obstacle to answering the primary research question. By analyzing the baseline definitions in the professional field of critical thinking, to include logical fallacy and cognitive bias, the scope of research can be narrowed and analyzed in respect to the critical thinking curriculum at the Command and General Staff College. The logical thought, synonymous with critical thinking, and the impediments to logical thought analyzed in this section further reinforce the idea that critical thinking is important in any field, the United States Army and Intermediate Level Education included.

---

<sup>42</sup> Ibid.

<sup>43</sup> A simple internet search under the term “logical fallacy” will yield a comprehensive list. Alternatively, wikipedia provides an aggregated list of know fallacies. [http://en.wikipedia.org/wiki/List\\_of\\_fallacies](http://en.wikipedia.org/wiki/List_of_fallacies).

### Section III: Command and General Staff Curriculum

The entire critical thinking curriculum for the ILE is complete within the first two weeks of education in ILE. After that point, no further direct education for critical thinking exists. It should be noted that critical thinking is still encouraged through classroom, peer-to-peer discussion, personal reflection time, Army Design Methodology sessions, and in all writing assignments. However, specific topics within the field such as logical fallacy, cognitive bias, or anchoring are not mentioned again.

Due to time constraints, no poll of the student body was conducted on the effectiveness of Intermediate Level Education critical thinking lessons. Under these circumstances, it was assumed that the majority of students that received the lessons are capable of not only explaining the basic concepts presented in the lessons, but are applying the subject matter through much of the adult learning models utilized in Intermediate Level Education. With few exceptions, the author observed critical thinking in multiple classrooms, in multiple staff groups.

The critical thinking curriculum in Intermediate Level Education begins in the core curriculum, specifically, C121: “An introduction to Critical and Creative Thinking”. This lesson, establishes the foundation of critical thinking by introducing the students to theorists in the field, such as Dr.s Paul and Elder, and Peter Facione.<sup>44</sup> In addition, this lesson also introduces the common framework definitions like cognitive bias, logical fallacy, intellectual standards, and elements of thought. It is during this time that ILE students are given a copy of “The Miniature Guide to Critical Thinking: Concepts and

---

<sup>44</sup> Command and General Staff College, C120, “Critical and Creative Thinking.”

Tools”<sup>45</sup> and are introduced to the first mental model in the critical thinking block of instruction.

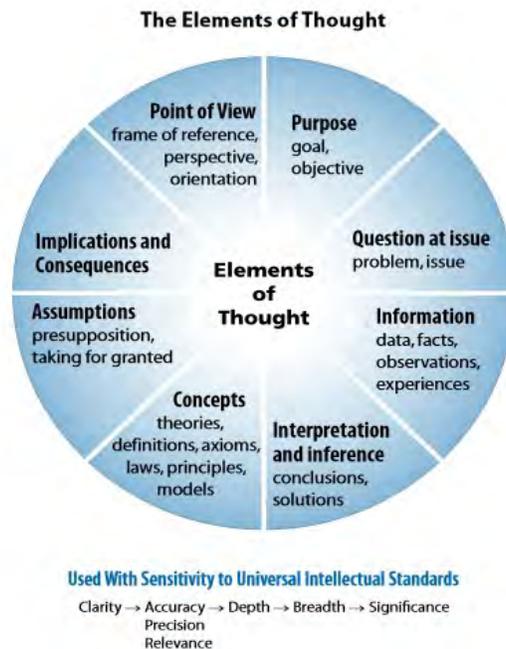


Figure 2. Elements of Thought Model

Source: Richard Paul and Linda Elder, *The Miniature Guide to Critical Thinking: Concepts and Tools*, 6th ed. (Dillon Beach, CA: Foundation for Critical Thinking, 2009).

The Elements of Thought mental model, depicted in figure 2, uses different variables when thinking critically. The lesson synopsis indicates that a model, like the one above, is utilized in the core curriculum and also when analyzing peer to peer arguments throughout the duration of the year. The school has placed some importance on this model, which is evident not only in the distribution of Paul’s and Elder’s books to

---

<sup>45</sup> Paul and Elder. *The Miniature Guide to Critical Thinking*.

students, but in large posters of the model that dot every staff group classroom within the ILE building.

In C122, students build on Facione, and Paul and Elders' concepts that were introduced in C121 by introducing the intellectual standards, cognitive bias and logical fallacy. According to the course syllabus, "The focus of the lesson is not what to think or even how to think, but how to become a better thinker and problem solver."<sup>46</sup> This lesson is the student's first realization that critical thinking cannot be summed up into a checklist like in the ARTEPs of the Army's past. The mental models introduced in this lesson include the previous elements of thought model in the Paul and Elders miniature guide, as well as the addition of three more models: the intellectual standards depicted in figure 3, and the intellectual traits depicted in figure 4, and the system that ties all three models together in figure 5.

---

<sup>46</sup> Command and General Staff College, C120, "Critical and Creative Thinking."

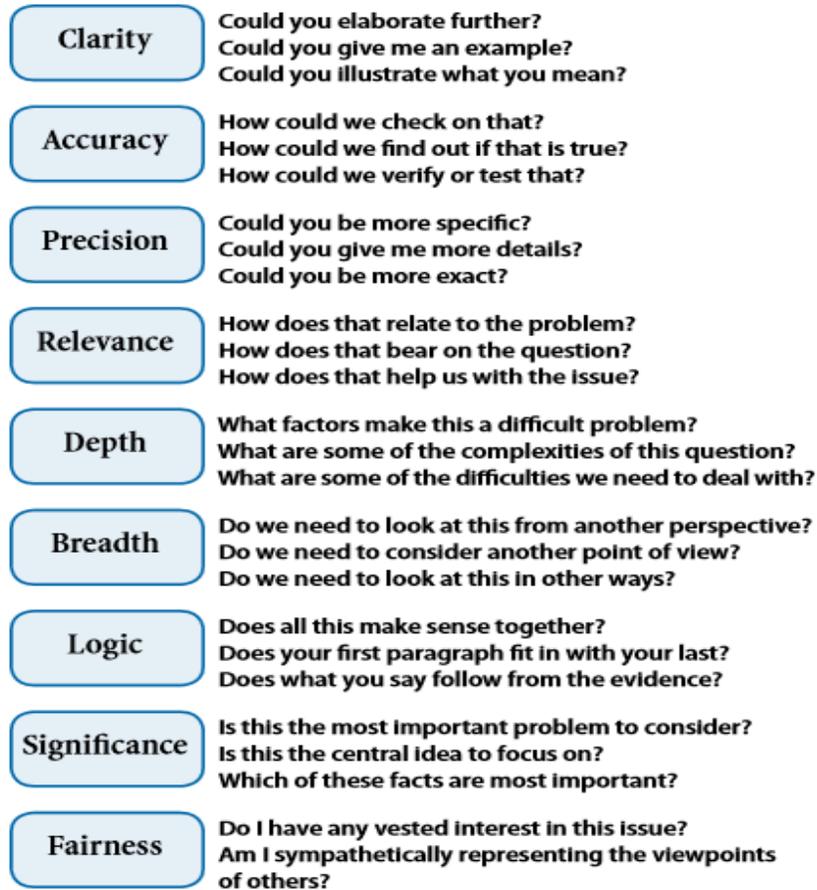


Figure 3. Intellectual Standards Model

Source: Richard Paul and Linda Elder, *The Miniature Guide to Critical Thinking: Concepts and Tools*, 6th ed. (Dillon Beach, CA: Foundation for Critical Thinking, 2009).

The Intellectual Standards mental model is introduced as a method for students to begin critical thinking by asking questions of arguments. Depicted in nine elements, students are encouraged to examine others arguments as well as their own, by running each argument through the model.



Figure 4. Intellectual Traits Model

Source: Richard Paul and Linda Elder, *The Miniature Guide to Critical Thinking: Concepts and Tools*, 6th ed. (Dillon Beach, CA: Foundation for Critical Thinking, 2009).

The intellectual traits are presented in a simple starburst model in figure 4. This demonstrates what academic critical thinkers should strive to emulate. The final model depicted in figure 5 depicts the relationship between the elements of thought, the intellectual standards, and the intellectual traits.

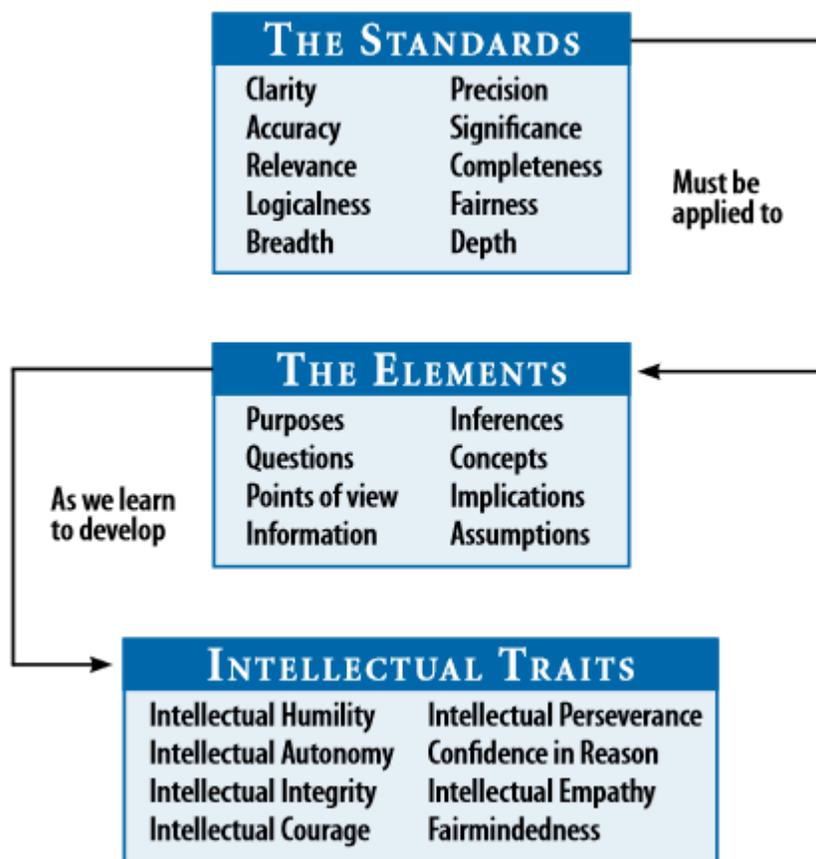


Figure 5. Critical Thinking Relationships

Source: Richard Paul and Linda Elder, *The Miniature Guide to Critical Thinking: Concepts and Tools*, 6th ed. (Dillon Beach, CA: Foundation for Critical Thinking, 2009).

In C123, ILE students are introduced to impediments to critical thinking, namely in the form of cognitive bias and logical fallacy. Although there are no mental models introduced in this lesson, the students are directed to online sources to determine the amount and scope of logical fallacy and cognitive bias that can exist within an argument.

In C124, students apply knowledge gained in the previous lessons learned through using a case study based on the 1967 Arab-Israeli War. Students are encouraged to critically think on the side of Egypt and Israel and utilize the models presented by Paul

and Elder in order to write a three-page paper on courses of action taken on either side. This paper allows students to apply the skills learned in subsequent critical thinking lessons toward three levels of conflict: strategic, operational, and tactical. No simulation is utilized during this lesson.

Noticeably absent from the critical thinking curriculum is the idea of anchoring, or the idea that humans have a tendency toward justifying actions based on initial experience. Technically, the college is not at fault for neglecting to mention this idea in the curriculum because anchoring falls under cognitive bias. Therefore, it is broadly covered under the umbrella of the cognitive bias lesson, but it is never directly addressed. Anchoring is a term that is actually referred to in behavioral economics and marketing professional fields. Dan Ariely best describes the concept of anchoring in his book *Predictably Irrational*. In chapter 2 of *Predictably Irrational* Mr. Ariely uses an anecdote about the giant coffee corporation, Starbucks®, to illustrate how humans tend to anchor themselves to higher price points based on initial experience. He cites that due to anchoring, Howard Schultz, the creator of Starbucks, was able to establish an anchor of higher priced coffee among patrons by creating a pleasing, coffee barista experience, that broke the lower priced Dunkin Donuts coffee anchor. In reality, the coffee is the same, but because the original anchor to a lower priced coffee was deceptively broken through experience, people were willing to pay higher prices. Mr Ariely makes the argument, that because of anchoring, Starbucks patrons use experience to justify the increase in cost, no matter how irrational. Conversely, a person who is now anchored to a Venti Starbucks

coffee would be shocked if the same price existed at Dunkin Donuts.<sup>47</sup> Coffee references aside, anchoring can be used to illustrate how officers, can be anchored to military experience as justification when making a decision in a military setting. As a patron is affected by price anchoring, a person can be affected by idea anchoring as well. Just as a Starbucks patron would justify paying three dollars more for coffee, an officer could just as likely cite a successful operation or a pleasing officer evaluation report as justification for a specific course of action, idea, or decision in a future scenario. Likewise, this same demographic could use anchoring as a way to bypass critical thinking altogether. Ultimately, anchoring is a proven cognitive bias and the only criteria required for persistent anchoring is to be untrained in its recognition.<sup>48</sup> It is not too far of a leap to consider that the C124 capstone critical thinking event is another rendition of strategic, operational, and tactical problem sets that students analyze while anchored to previous experience. The critical thinking lessons in Intermediate Level Education are designed to overcome these natural human inclinations to anchor onto ideas as well as other forms of logical fallacy and cognitive bias, however, when it comes to the application of these critical thinking skills, students may rarely venture far from the corner Dunkin Donuts. It can be argued that stubbornness and unwillingness to change, stems from cognitive bias anchoring.

The effectiveness of the Intermediate Level Education critical thinking curriculum is not the focus of this research; rather, the focus lay on the understanding of how

---

<sup>47</sup> Dan Ariely, *Predictably Irrational: The Hidden Forces That Shape Our Decisions* (New York, NY: HarperCollins Publishers, 2008).

<sup>48</sup> ScienceDaily, “Anchoring Bias in Decision-Making,” accessed May 14, 2015, <http://www.sciencedaily.com/terms/anchoring.htm>.

modeling and simulation could enhance the lessons already provided. The base critical thinking lessons and the models presented in the core curriculum cover what professionals in the field of critical thinking consider to be important for students, however, because the skills that are taught in these lessons are being applied through paper writing and MDMP sessions, students might still be subject to the same cognitive bias anchoring that they are encouraged to overcome. This implies that the lessons are being received by students, but does not indicate if the students are actually applying the lessons correctly, or at all. This cognitive bias anchoring was observed specifically during the O299 exercise by the author, when students demonstrated an anchor to conventional ideas, when contemplating attacks by unconventional organizations.

#### Section IV: Simulation Enhanced Critical Thinking

Two areas were researched in order to answer the primary research question “How can modeling and simulation enhance critical thinking in Intermediate Level Education?” The first consisted of a focus on direct simulation methods for enhancing these lessons. The purpose of direct simulations is to assist students by directly reinforcing the basic skills taught in the ILE core critical thinking lessons. The second researched area consisted of utilizing indirect simulation methods to reinforce critical thinking. Indirect methods consist of computer simulations that can reinforce critical thinking skills outside of the original core lessons in Intermediate Level Education. These indirect simulations are the visual means to which previously attained critical thinking skills can be applied. The simulation, Decisive Action ® and Eve Online ® both fit into the indirect method category.

Of the direct simulation methods researched, one with some promise came from a program called Computerized Training in Critical Thinking (CT2).<sup>49</sup> In November of 2006, a seven yearlong research study was published by Susan Fischer on the use of web based programs for instruction of critical thinking within the United States Military. The study echoed what other experts in the field of critical thinking have stated about the military: that the military is a process-based organization and reliant on standardized thinking models, which are in stark contrast to the divergent thinking required in critical thought. The study notes that because of this phenomena within the military, resources for critical thinking education and training pale in comparison to resources provided to train in the military decision making process, the rapid decision making process, and the Army Design Methodology.<sup>50</sup> It is under this premise, that the study proposed low resource web based simulation to enhance resource constrained critical thinking training programs.

CT2 was developed under 18 guiding principles, which are listed in figure 6.

---

<sup>49</sup> Fischer, *Computerized Training in Critical Thinking (CT)<sup>2</sup>*.

<sup>50</sup> Ibid.

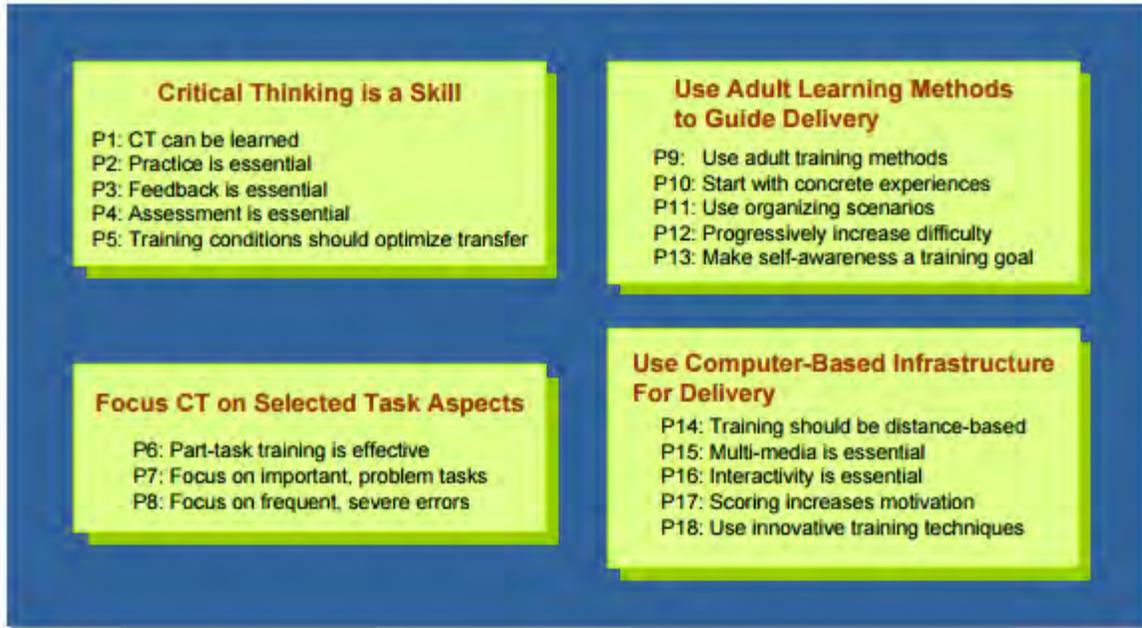


Figure 6. Guidelines for CT2 Development

Source: Susan C. Fischer, *Computerized Training in Critical Thinking (CT)<sup>2</sup>: A Skill-based Program for Army Personnel* (Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences, 2009).

The principles block “Critical Thinking is a Skill” falls within the realm of what is already established and in practice in the critical thinking core curriculum in ILE, as is the case with the “Use Adult Learning Methods to Guide Delivery” and “Focus CT on Selected Task Aspects” blocks. However, the guiding principle block “Use Computer Based Infrastructure” is absent from the ILE core curriculum. Ms. Fischer indicates that direct simulations for training critical thinking should be developed under a distance-learning model and should utilize all forms of multimedia that the current generation of military officers are used to. This is important for two reasons: First, in order to utilize a program that reinforces skills, the program must be easily accessible; to include reducing install time and removing any barriers that prevent the user from accessing past data and

statistics.<sup>51</sup> Second, the program would need to take advantage of all multimedia methods available such as video, games, audio, tables, and other interactive platforms in order to not reduce the training programs to “electronic page turning.”<sup>52</sup> The analysis in Ms. Fischer's study indicates that multimedia alone is sufficient to captivate a student audience and enhance critical thinking lessons in the classroom; however, she goes even further by addressing the need for interactivity and scoring; concepts that are common in modern education in the 21st century.<sup>53</sup>

The research shows that a CT2 based model can be incorporated into any curriculum based on critical thinking. Due to the web based nature of the program, simple programming of CSS, Java, HTML, or JAVASCRIPT languages can be utilized to meet any of the terminal learning objectives outlined in the ILE core curriculum. For instance, the mental models introduced in the Paul and Elder text can be animated using JAVASCRIPT and available to students to utilize while forming arguments in both the ILE core curriculum, as well as during subsequent discussions that are outside of the core curriculum. Likewise, the core skills developed by Facione and discussed in chapter 2 could easily be simulated in preparation for application during to future exercises. Further, the use of web-based programming can be utilized to practice skills grounded in critical thinking, such as, recognizing inherent bias in arguments or logical fallacy. This can be accomplished through a simulation of a biased argument, and have the student analyze the argument by building a logic model in the program. In this context, the

---

<sup>51</sup> Ibid.

<sup>52</sup> Ibid.

<sup>53</sup> Ibid.

applications are endless. The key point to remember is that CT2, or any multimedia simulation can enhance ILE lessons by bolstering the syllabus status quo with more interaction from the students, and less “page turning.”

One of the more important discussions in Ms. Fischer’s study centers on the effectiveness of computer based simulation on critical thinking lessons, or rather, how effective is CT2 compared to normal “turn page” instruction. Ms. Fischer’s research indicated through a one-way analysis of covariance (ANCOVA) experiment that the critical thinking lesson “when to seek information based on value and cost” showed that student groups trained using CT2 methods had higher post test averages than those that did not. Table 1 displays the results of Ms. Fischer’s experiment.

Table 1. CT2 Experiment Findings

Group	Pretest Mean (SD)	Posttest Mean (SD) (unadjusted)	Posttest Mean (SD) (adjusted)
Training (N=10)	50.5 (11.2)	64.0 (8.4)	61.4 (8.4)
No Training (N=11)	42.3 (13.8)	47.7 (12.3)	50.1 (12.3)

Source: Susan C. Fischer, *Computerized Training in Critical Thinking (CT)<sup>2</sup>: A Skill-based Program for Army Personnel* (Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences, 2009).

Table 1 demonstrates that the posttest averages after a 15 minute CT2 lesson (indicated in the post test mean) was higher in the “Training” column than the “No training column.” Although the difference between the adjusted numbers and the unadjusted numbers were not explained in Ms. Fischers study, the training column still

indicates a greater increase in skill understanding over the “No training” column and should not be dismissed. The means were based on a maximum of 100. The experiment only tested a single lesson in critical thinking and further research is needed to deduce the efficacy of CT2 on the other complex lessons discussed previously in this thesis. The current data is promising, and is indicative that practicing skills in a medium that current generation students are used to (computers, internet, multimedia) may lead to better understanding of the subjective nature of critical thinking. Because Ms. Fischer's experiment compares a CT2 control group against a group that was representative of the average Army officer, it is unclear if CT2 is a better method than the current “page turning” techniques utilized in the ILE core curriculum; the previous critical thinking training of the “untrained group” was unknown at the time of the experiment. However, we can deduce that Ms. Fischer's experiment establishes that the repetition provided by a program like CT2 is enough to inculcate a critical thinking skill in a group of ILE students. CT2 can potentially provide the repetition and reinforcement to critical thinking skill development that is emphasized by leading critical thinking theorists.

Unlike direct simulation methods for teaching critical thinking lessons, indirect methods are already in use in Intermediate Level Education. The O299 course, “Execute Major Operations” is a simulation driven training exercise that relies heavily upon standardized decision making models such as the Military Decision Making Process (MDMP) and the Rapid Decision Making Process (RDMP). The exercise also relies on the use of another standardized process called, Army Design Methodology (ADM), which was discussed in chapter 2 of this thesis. The exercise spans several weeks of class time and allows students to form teams and work through issues on a staff level. The

simulation utilized during this exercise is a constructive simulation titled Decisive Action ®. Decisive Action ® is a low overhead simulation developed in house at the Command and General Staff School. In line with indirect simulation methods, Decisive Action ® does not directly teach cognitive bias, logical fallacy, or the elements of thought; rather, it visually depicts a scenario that affords students the opportunity to experiment with new tactics, staff processes, or reinforce the results of critical staff thinking, at least, in theory.

In “Critical Thinking in the 21st Century” Major General (Retired) Lon E. Maggart placed simulations as one of the cornerstones for developing critical thinking within the Army.<sup>54</sup> The scenario he depicted in his article, paints a picture of students applying Army Design Methodology, problem framing, and critical thinking toward an environment that is easily depicted visually and also infinitely repeatable with little overhead.<sup>55</sup> The O299 exercise along with Decisive Action ® as a driver, has the potential to achieve Maggart’s vision of simulations enhancing critical thinking in ILE by creating a visual environment where students could easily apply critical thinking skills during Army Design Methodology and through decision making while the simulation is running. The use of Decisive Action ® during the O299 exercise affords the students the opportunity to visualize conventional tactical situations, in a way that the students might not have experienced prior to arriving at the Command and General Staff School. This visualization is in line with Maggart’s criteria of being infinitely repeatable with low overhead.

---

<sup>54</sup> Maggart, “Critical Thinking in the 21st Century.”

<sup>55</sup> Ibid.

Mentioned earlier in this chapter, cognitive bias anchoring is a potential hurdle to overcome when developing critical thinking skills, especially in military environments where students have the potential to remain anchored to previous experience and doctrine. Although Decisive Action ® can create a visualization that students can critically think about; the visualization is based on scenarios that can reinforce cognitive bias instead of critical thinking. For instance, an officer might be inclined to skip critical thinking when understanding the environment, as the environment that Decisive Action ® simulates closely resembles common force on force scenarios that are ubiquitous in the Army. Dan Ariely would surmise that the mere suggestion of a number is enough to anchor an individual to a certain price point.<sup>56</sup>

Under this premise, we can deduce that a mere suggestion of a certain type of common military scenario is enough to anchor an officer to a tactic or approach, thus bypassing critical thinking altogether. Rather than think about an opposing force tactic, a student could simply cite past rotations at a training center, or cite former soviet doctrine. In this case, the mention of standardized force on force scenarios is enough to anchor students to unoriginal ideas and concepts.

Another aspect to consider is that Decisive Action ® is more than capable of replicating tactical scenarios to incite critical thinking, however, is incapable of simulating abstract and subjective organizations such as terrorist cells, insurgent behavior, or the effects of economy on a people. All of these are variables that ILE students expect to critically think about when understanding an environment, in or out of the classroom. Susan Fischer best stated the importance of critically thinking about these variables:

---

<sup>56</sup> Ariely, *Predictably Irrational*.

Army leaders are also finding themselves in situations that bear little resemblance to conflict situations they have previously experienced or studied. In recent years, they have been expected to serve peacekeeping roles, for example, in which their job is to control conflict among two or more opposing and hostile groups within a foreign country. In such situations, learned rules of engagement and principles of warfare often do not apply. There is no single enemy and battle lines may not exist. In such situations, novel solutions that are the product of CT are likely to be critical to success.<sup>57</sup>

If critical thinking is to occur both in and out of the classroom around these variables, then another simulation should be considered in addition to the tactical scenario generating Decisive Action ®.

Eve Online ®, discussed previously in chapter 2 of this thesis, is a notoriously difficult massive multiplayer online role-playing game; it also falls into the category of indirect simulations. What makes Eve Online ® unique as a simulation is that there are few rules associated with its digital universe. Players are free to form alliances, trade in markets, exploit resources, spy, play in political arenas, create and distribute propaganda, or even play the game as a news pundit.<sup>58</sup> In large part, the 450,000 players that make up the universe, have created a living world that closely mirrors the real one. To illustrate this depth, the economy of Eve Online has trends that fluctuate and are capitalized on by players that are versed in economics. Figure XX illustrates some of the detailed market information available on a single valuable resource within the game.

---

<sup>57</sup> Susan C. Fischer and V. Alan Spiker, *Critical Thinking Training for Army Officers* (Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences, 2009).

<sup>58</sup> EVE Online, "True Stories," accessed February 7, 2015, <https://truestories.eveonline.com/>.



Figure 7. In Game Screen Shot

*Source:* EVE Online, EVE Online Is a Massive Multiplayer Online Roleplaying Space Game, accessed May 10, 2015, <https://www.eveonline.com/>.

Figure 7 represents an in game screenshot of 3 months of market data on a mineral that is traded within the game called “Zydrine.” The graph depicts a moving average, donchian channel, median day price, as well as daily volume traded. In the case of zydrine, events within the game world have caused a significant spike and then drop in price between April and May. In turn, the volatility of this resource causes conflict at the strategic, operational, and tactical levels between player made alliances that covet the material within the game. It is because of information and scenarios surrounding traded commodities like Zydrine, that CCP games, the developers of the online universe, employ

a fulltime economics professor to monitor the game's digital economy. Dr Eyjolfur Gudmundsson, describes how he manages the in game economy.

[I]f I notice anything that is ongoing in the economy that I think is probably in the wrong direction; I have a meeting with the game designers about possible solutions, about sorting the problems. To give a real world analogy, it is very much like a central bank dealing with governments. Sometimes they agree, sometimes they disagree, but together they have to manage the economy and make it happen.<sup>59</sup>

The economy within the game is just a single operational variable that illustrates the complexity of Eve Online ® and how it mirrors real world economies. Other operational variables, such as the military landscape, can be observed and critically thought about as well. With an economy that is as robust as Eve Online's, conflict among the players is often ubiquitous. Conflict can range from small tactical skirmishes, to operational campaigns, to national strategy that employs all of the elements of national power: diplomatic, information, economic, and military. Figure 8 is a visual depiction of the player alliances that mimic nation states in the game world that are player created and run. This map changes with time, based on conflict and diplomatic statuses between the warring nations. Although the map depicted in Figure 8 has a setting is in a space environment, the conflict along the borders, the motivations behind the leadership of the player alliances, and the tactical decisions that are made by the players that shape the depicted national borders, all reflect concepts and ideas from the real world ; concepts that can be utilized to enhance the ILE lessons and develop critical thinking skills.

---

<sup>59</sup> Rich Stanton, "Money Talks: An Interview With EVE Online's Economist," Rock Paper Shotgun, accessed May 10, 2015, <http://www.rockpapershotgun.com/2014/05/21/eve-economist-interview/>.



Figure 8. In Game Screenshot

*Source:* EVE Online, EVE Online Is a Massive Multiplayer Online Roleplaying Space Game, accessed May 10, 2015, <https://www.eveonline.com/>.

The point to consider with Eve Online ® is that it replicates an environment that has conflict familiar to an ILE student, however, takes place in an environment that removes the potential to anchor to past solutions. The space environment of Eve Online ® simply does not have a precedent within the walls of ILE; therefore students would truly be forced to critically think during the “understand the environment” section of Army Design Methodology. For instance, the Red.Overlord alliance depicted in the southern region of Figure 8 is an alliance composed of eastern European players who share a common language and heritage both in game and out. If an ILE student were tasked to understand the Red.Overlord alliance, they would have to consider the relationship between Red. Overlord and the Against all Authorities alliance who share borders, trade

routes, markets and a common enemy in the form of the Atlas alliance to the East. In an attempt to understand the environment surrounding Red.Alliance, ILE students could easily apply the original six core critical thinking skills developed by Peter Facione: analysis, inference, explanation, evaluation, self-regulation, and interpretation, while being free from any anchors that may be reinforced by a common tactical simulation.

Another point to consider is that Eve Online ® simulates some of the more abstract and subjective concepts in modern warfare. Aside from large alliances and coalitions within the game world, Eve Online ® has simulated digital terrorist cells, pirate networks, and information oriented organizations since the games original inception in 2003. Since these organizations are largely not as familiar to ILE students as conventional organizations, students are likely to apply critical thinking skills toward understanding them in an exercise. Eve Online ® would certainly be able to provide some skill repetitions if a student were tasked with understanding a “pirate” organization within the game world.

A certain drawback to incorporating Eve Online ® into the CGSC curriculum is that the argument can be made that Eve Online has such a steep learning curve, that students would spend time focusing on the mechanics of interacting with other players and entities more so than critically thinking about the problem sets established beforehand. Because of the steep learning curve of the game, any implementation would likely have to be monitored closely by the educator utilizing the simulation.

#### Section V: Conclusion

In conclusion, the analysis shows that the critical thinking curriculum in the CGSOC lays a sufficient foundation for critical thinking basics. The C100 lessons

provide mental models based on the research of Paul and Elders, and set the framework for adult learning and discussion for the remainder of the ILE course. The C100 lessons, however, only provide models, leaving out direct and indirect simulations methods that would otherwise enhance the teaching methods already in place. The analysis also shows that direct simulation methods are capable of providing an easy access, low overhead method to reinforce basic critical thinking concepts such as logical fallacy identification, cognitive bias recognition, and using the elements of thought over time and in specific situations. Lastly, the use of indirect simulation methods can reinforce concepts learned during the C100 curriculum by providing near realistic visualization of complex situations. The problems associated with indirect simulations, specifically Decisive Action ® is that there is the potential for the simulation to reinforce anchoring to previous ideas and experience, and bypass critical thinking altogether. This potential issue is circumvented by introducing simulations with alien environments, such as Eve Online ®, in order to break any potential anchors that an ILE student might have. Eve Online ® provides a realistic conflict simulation that can break common anchors in Army officers, by creating a setting in which students are unfamiliar, in order to reinforce critical thinking skills.

## CHAPTER 5

### CONCLUSIONS AND RECOMMENDATIONS

The essence of the independent mind lies not in what it thinks, but in how it thinks.

— Christopher Hitchens, *Letters to a Young Contrarian*

#### Section I: Introduction

Never has there been a time when critical thinking is required by the US Army officer corp. As the operational environment is seeded with more problems that are subjective in nature and with organizations that do not yet have a historical precedent; it will be up to the Corps of Army Officers to think critically and creatively about and through these problems. Throughout the research period of this thesis, it was never in question that the critical thinking curriculum in Intermediate Level Education was in any way, inadequate in teaching its lessons, rather, just the opposite. The foundation laid out in the Intermediate Level Education Core Curriculum is presented to students in a reasonable manner that sets an academic tone for peer-to-peer discussion throughout the course. It is under this premise that the predominant purpose of this thesis is the determination as to whether or not modeling and simulation can enhance the critical thinking curriculum in ILE. This chapter will present the conclusions and recommendations based on the analysis of the subject matter presented in previous chapters. First, the primary research questions will be answered with an affirmation. Next, a recommendation will be presented to enhance the critical thinking curriculum through direct simulation. Finally, a recommendation will be presented that ties into indirect simulation methods. Ultimately, modeling and simulation can enhance the critical

thinking curriculum in Intermediate Level Education through two facets; the first, being the use of direct simulation methods such as computerized training for critical thinking (CT2). The second, is the use of indirect simulation methods; one of which, Decisive Action ® , is routinely used during the 0299 curriculum in Intermediate Level Education, the other, Eve Online ® is not in use at all.

## Section II: Direct Simulation

The analysis presented in chapter 4 of this thesis shows that there is quantifiable data that a direct simulation such as Computerized Training for Critical Thinking can increase lesson retention rates for students that use such programs, over students that rely on conventional page turning methods. A direct simulation method used in training critical thinking should be implemented into the core curriculum of ILE.

Since the research executed by Susan Fischer on Computerized Training for Critical Thinking is limited to a single quantifiable example, the recommended enhancement to the curriculum should be focused narrowly on assisting the student comprehend the basics of critical thinking. The program can be utilized to increase student understanding of more advanced critical thinking concepts such as the application of the elements of thought in an argument. However, simple concepts, such as the recognition of cognitive bias and logical fallacy, are better suited to the amount of resources and time available to both faculty and students alike.

The current critical thinking curriculum in ILE utilizes page turning methods to inculcate the recognition of impediments to critical thinking. The C123 lesson in the ILE core curriculum directs students to outside web sources that list certain cognitive biases and logical fallacies. This homework is then followed up by a small block of peer to peer

discussion. If this lesson block were to be replaced with an easier to access method and a simulation similar to that represented in Susan Fischer's work, students would be able to utilize the multimedia inherent in modern simulation to learn and recognize the impediments to critical thought that the lesson attempts to teach. The simulation itself should follow a model similar to Susan Fischer's Computerized Training for Critical Thinking, where students are presented with repetitive scenarios and definitions. This method has a significantly low overhead and can be created in an afternoon of html programming.

### Section III: Indirect Simulation Methods

The second recommendation to enhance the critical thinking curriculum in ILE relies on the use of indirect simulations. The analysis in chapter 4 of this thesis covered the use of the simulation, Decisive Action ® during the O200 curriculum. The simulation is utilized during O200 to create a visualization after students develop plans and orders based on the standardized Military Decision Making Process. After the student plan is complete and approved, the Decisive Action ® simulation creates a near real time scenario where students can critically think about complex tactical scenarios. During this lesson, critical thinking is potentially utilized by the students but not reinforced in any formal way within the C200 curriculum. Students are still subject to standardized processes that do not usually reinforce the divergent thinking required for critical and creative thinking. In addition, Decisive Action ® does not simulate problem sets above the tactical level of conflict and does not break any potential anchors students might have in regards to experience. A potential solution to enhance the critical thinking skills is to continue utilizing the Decisive Action ® simulation and alter the training objectives for

the O299 exercise to include an emphasis on core critical thinking concepts taught in the C100 series of classes. Doing this has the potential to reinforce the previous “basics” presented in the core curriculum while analyzing common tactical scenarios.

Additionally, Decisive Action ® does not fully replicate the abstract organizations that ILE students are expected to critically think about. The organizations, such as terrorist cells, terrorist tactics, economies, and other subjective concepts are outside of the realm of conventional military tactics, are present in the real world, and are absent from the majority of applied critical thinking lessons in ILE.

Another indirect simulation method is the introduction of the space based massive multiplayer online game Eve Online ® into the curriculum in Intermediate Level Education. Eve Online ® has the potential to enhance the critical thinking lessons taught by simulating real world conflict that can be analyzed in a realistic manner through the use of Army Design Methodology. By introducing Eve Online ® into Army Design Methodology lessons in the ILE curriculum, students will be forced to truly understand a foreign environment that has never been encountered previously. Additionally, Eve Online ® can be utilized to enhance divergent thinking methods by tasking students within ILE to complete a simple goal within the game world. “Infiltrate a large corporation within the game world.” or “make 100,000,000 of the in game currency” are simple tasks that would stimulate the students to understand the digital environment before identifying and overcoming the obstacles required to meet the task. This mirrors Army Design Methodology, with the added bonus of providing an environment that discourages anchoring and reinforces Peter Facione’s six core critical thinking skills. Students would then be able to discuss their operational approaches inside of the ILE

adult learning model, which would further enhance critical thinking lessons within Intermediate Level Education. Additionally, Eve Online ® replicates abstract organizations like terrorist and pirate cells and would aid in ILE critical thinking in this currently unrepresented area.

#### Section IV: Conclusion

The critical thinking curriculum in Intermediate Level Education can be effectively enhanced with the use of modeling and simulation. The two methods that can enhance the C100 curriculum center around the use of direct simulation methods and indirect simulation methods. Susan Fischer's work on computerized training for critical thinking provides quantifiable evidence that lessons that utilize simulation and other forms of multimedia enhance student retention of critical thinking concepts. Although the program, as well as the research into the program, is immature, the low overhead and ease of access provided by a direct simulation will potentially inculcate critical thinking concepts in ILE. The critical thinking lessons of Intermediate Level Education are also enhanced through indirect simulation methods, one of which is already utilized in the academic school year. Introducing a critical thinking training objective during the O299 exercise will potentially allow students to refine plans and scenarios through critical thinking and the elements of thought prior to and during the utilization of the Decisive Action ® simulation. The potential for cognitive bias anchoring still exists, even with the use of Decisive Action ®, however, this can be remedied by introducing Eve Online ® into the ILE curriculum. The space theme of the simulation coupled with the reflection of real life interactions has the potential to break common cognitive bias anchoring, and stimulate the students to think critically in order to be successful within the simulation.

It should be noted that for the successful implementation of any simulation in the critical thinking curriculum of ILE, the importance of the adult learning model should not be overlooked. This was addressed briefly in chapter 2 of this thesis when referencing Maggart's model for inculcating critical thinking in Army officers. Although the simulations researched in this thesis provide the repetition and visualization needed to practice critical thinking skills, it is through the adult learning model that balance is achieved between critical thinking in a simulated world, and critical thinking in the real world. The adult learning model that is utilized in Intermediate Level Education ensure that peer to peer discussion will always temper conclusions based on simulation.

Lastly, this thesis raises some questions that require further research. There were moral questions that were raised with the subject of critical and creative thinking in the classroom. Namely, does practicing unhindered critical thinking through simulation cross any moral boundaries? As the author researched Eve Online ® it was determined that some of the simple proposed tasks that stimulate critical thinking in students could yield reasonable conclusions that crossed the lines of morality in the officer corps. As an example, the task presented earlier in this chapter to “acquire 100,000,000 of the in game currency” could be achieved through piracy or social engineering just as easily as through legitimate work. The idea that critical thinking through simulation could possibly corrupt the moral code of certain people is a broad topic, and would require further research to determine the outcome. The philosophical nature of the question was also simply too subjective to include in the original narrow scope of this thesis.

The author would also like to acknowledge that the breadth and scope covered in this thesis regarding Eve Online ® as a tool for training critical thinking has only

scratched the surface of what the game is capable of. Eve Online's simulated world should be researched on its ability to teach lessons on morality, propaganda, economics, marketing, and warfare. Further research is most certainly required to determine the place of Eve Online ® as well as other massive multiplayer online games in any formal training, ILE included.

The last question that was raised and requires further research, is the impact of instructor buy in with the use of any simulation to reinforce learning in the classroom. The author observed that even though Decisive Action ® was utilized in ILE, some staff group instructors seemed more comfortable operating the simulation than others. A measurable outcome of multiple ILE instructor use of simulations was not directly observed, however, personal interaction with students and instructors indicates that further research is required to determine the effects of instructor comfort level and “buy in” on the use of simulations in the classroom.

## BIBLIOGRAPHY

Ariely, Dan. *Predictably Irrational: The Hidden Forces That Shape Our Decisions*. New York, NY: HarperCollins Publishers, 2008.

BrainyQuote. "Simulation Quotes." Accessed May 10, 2015.  
<http://www.brainyquote.com/quotes/keywords/simulation.html>.

Command and General Staff College. C120, "Critical and Creative Thinking," Advance Sheet, Syllabus for Academic Year 15. Fort Leavenworth, May 10, 2015.

Decisive-Point. "What's a Serious Game." Accessed May 10, 2015.  
<http://www.decisive-point.com/>.

Department of the Army. Army Regulation (AR) 5-11, *Management of Army Modeling and Simulation*. Washington, DC: Government Printing Office, 2014.

EVE Online. "True Stories." Accessed February 7, 2015.  
<https://truestories.eveonline.com/>.

———. EVE Online Is a Massive Multiplayer Online Roleplaying Space Game. Accessed May 10, 2015. <https://www.eveonline.com/>.

Facione, Peter A. *Critical Thinking: What It Is and Why It Counts*. Millbrae, CA: California Academic Press, 1998.

Fischer, Susan C. *Computerized Training in Critical Thinking (CT)<sup>2</sup>: A Skill-based Program for Army Personnel*. Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences, 2009.

Fischer, Susan C., and V. Alan Spiker. *Critical Thinking Training for Army Officers*. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences, 2009.

Grome, Anna, Beth Crandall, Louise Rasmussen, and Heather Wolters. *Army Design Methodology: Commander's Resource*. Arlington VA: Army Research Institute for the Behavioral and Social Science, February 2012.

Guillot, W. Michael. "Critical Thinking for the Military Professional." *Air and Space Power Journal* (2004). Accessed September 10, 2014. [https://wss.apan.org/s/JSOFUN/Shared%20Documents/CriticalThinking/Critical\\_Thinking\\_For\\_The\\_Military\\_Professional.pdf](https://wss.apan.org/s/JSOFUN/Shared%20Documents/CriticalThinking/Critical_Thinking_For_The_Military_Professional.pdf).

- Haselton, Martie G., and Daniel Nettle. "The Paranoid Optimist: An Integrative Evolutionary Model of Cognitive Biases." *Personality and Social Psychology Review* (2006): 47-66.
- High Drag. "An Eve Online Podcast and Blog." Accessed May 10, 2015. <https://highdrag.wordpress.com>.
- Maggart, Lon E. "Critical Thinking in the 21st Century." Lecture, Training Critical Thinking Skills for Battle Command: ARI Workshop from U.S. Army Research Institute for the Behavioral and Social Sciences, Fort Leavenworth, July 1, 2001.
- NC State University. "Critical and Creative Thinking Definition." Accessed October 10, 2014. <http://accreditation.ncsu.edu/critical-creative-thinking-definitions>.
- Paul, Richard, and Linda Elder. *The Miniature Guide to Critical Thinking: Concepts and Tools*. 6th ed. Dillon Beach, CA: Foundation for Critical Thinking, 2009.
- Princeton.edu. "Cognitive Bias." Accessed May 10, 2015. [http://www.princeton.edu/~achaney/tmve/wiki100k/docs/Cognitive\\_bias.html](http://www.princeton.edu/~achaney/tmve/wiki100k/docs/Cognitive_bias.html).
- ProCon.org. "Critical Thinking Quote: Adrienne Rich." Last updated August 8, 2013. Accessed October 10, 2014. <http://www.procon.org/view.background-resource.php?resourceID=005392>.
- Purdue OWL. "Logical Fallacies." Accessed March 17, 2015. <https://owl.english.purdue.edu/owl/resource/659/03/>.
- ScienceDaily. "Anchoring Bias in Decision-Making." Accessed May 14, 2015. <http://www.sciencedaily.com/terms/anchoring.htm>.
- Smartwar.org. "Ray Odierno's Reading List." Accessed September 6, 2014. <http://www.smartwar.org/reading-list/ray-odierno/>.
- Stanton, Rich. "Money Talks: An Interview With EVE Online's Economist." Rock Paper Shotgun. Accessed May 10, 2015. <http://www.rockpapershotgun.com/2014/05/21/eve-economist-interview/>.
- United States Army Combined Arms Center. "Command and General Staff College (CGSS)." Accessed May 5, 2015. <http://usacac.army.mil/organizations/cace/cgsc/cgss>.
- . "CGSC Intermediate Level Education." Accessed February 10, 2015. <http://www.cgsc.edu/ile/summary.asp>.
- Vergun, David. "Odierno: Leader Development No. 1 Priority." The Official Homepage of the United States Army. Accessed May 10, 2015. [http://www.army.mil/article/120024/OdiernoLeader\\_development\\_No1\\_priority/](http://www.army.mil/article/120024/OdiernoLeader_development_No1_priority/).

Your Deceptive Mind. Performed by Steven Novella. United States: The Great Courses [Audible], 2012. Audio Book.

Your Logical Fallacies. "Thou Shalt Not Commit Logical Fallacies." Accessed January 17, 2015. <https://yourlogicalfallacies.com/>.