I, Mark C Nicholas, hereby submit this original work as part of the requirements for the degree of Doctor of Philosophy in Educational Studies.

It is entitled: Faculty Conceptualizations and Approaches to Assessing Critical Thinking in the Humanities and Natural Sciences – A Grounded Theory Study

Student's name: Mark C Nicholas

This work and its defense approved by:

Committee chair: Miriam Raider-Roth, EdD

Committee member: Heidi Goodrich Andrade, EdD

Committee member: Lanthan Camblin, PhD

Committee member: Wayne Edward Hall, PhD

2005
Faculty Conceptualizations and Approaches to Assessing Critical Thinking in the Humanities and Natural Sciences – A Grounded Theory Study

A Dissertation

Submitted to the Graduate School of the University of Cincinnati

In partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY (PhD)

In the Department of Educational Studies
College of Education, Criminal Justice, and Human Services

2011

by

Mark C. Nicholas

Committee Chair: Miriam B. Raider-Roth, EdD
**Abstract**

Empirical research on how faculty across disciplines conceptualize or assess CT is scarce. The debate on whether CT is discipline-general or discipline specific has long remained a theoretical one. However, the assumption that CT is discipline-general has informed curricular and assessment approaches in general education and is pervasive in higher education. These theoretical assumptions remain untested with the realities of how CT operates in the undergraduate classroom. There is little empirical evidence on whether discipline-general means and methods used to assess CT match faculty approaches in the classroom. Nonetheless, the assessment of students’ ability in CT have been measured using discipline-general standardized tests and rubrics and faculty and institutions have been called out for their contributions to developing CT in students based on the outcomes of such measures.

This investigation focused on a group of 14 faculty drawn from multiple disciplines in the humanities and natural sciences. Using in-depth interviews, focus group discussions, assessment artifacts and qualitative coding strategies, this study examined how faculty conceptualized the term CT and how they assessed for CT in general education. The study adopted an exploratory approach to study faculty conceptualizations of CT and hence did not use an operational definition of CT. This study found that that disciplinary approaches, ontological assumptions and personal epistemologies influenced the way faculty from the natural sciences and humanities conceptualized CT.

The findings revealed that within disciplinary, educational contexts, faculty took a faceted approach to CT focusing on aspects of CT that were most relevant to their disciplinary needs. Faculty also held assumptions on the ontology of CT that influenced their understanding on the properties of the term. Faculty across disciplinary lines generally worked under the
assumption that CT was dependent on context. Unanimity also emerged that CT was integrated with disciplinary content and other learning outcomes. The ontological assumptions that faculty held on CT were found to influence pedagogy and assessment of CT. The study found that faculty used implicit approaches to both teach and assess CT. Hence they had no way of knowing the efficacy of their approaches; leading to what I called the hopeful pedagogy.

Although many have speculated on the relationship between CT and personal epistemology, this study represents one of the first empirical works to examine these speculations in the context of how faculty as assessors of CT, made their judgments. I found that when gauging whether thinking was critical or evaluating the premises of arguments, faculty drew from their personal epistemologies to make such judgments. Beliefs that faculty held on the nature of knowledge, the relationship between the knower and the known, and the criteria they used to justify knowledge claims influenced their judgments of the outcome of the critical thinking process. It was difficult to argue from the data whether the nature of disciplinary approaches and methods cultivated and reinforced personal epistemology or whether it was the reverse.

The study found a mismatch between approaches used to assess CT in widely used standardized tests, general education programs and in national efforts for accountability versus the approaches used by faculty to assess CT. It raised questions on the efficacy and continued use of discipline-general approaches to assess CT in all students irrespective of discipline and called for a complex, multi-disciplinary approach with multiple forms of assessment. Given findings of how faculty approached CT, the value of a liberal general education lies not in the generality of CT but its multidisciplinariness. The findings of this study have implications for the assessment of CT, faculty development, and for conceptual understandings of CT.
Copyright 2011

Mark C. Nicholas
To the Divine

and my mother Wendy Nicholas
Acknowledgements

I want to thank the Division of Educational Studies and Leadership and the College of Education, Criminal Justice, and Human Services at the University of Cincinnati for giving me the opportunity and generous scholarships to pursue and complete this degree.

I want to express my deep gratitude to my Committee Chair, Miriam Raider-Roth for sticking with me even when I did not make any sense. Thank you for your patience and encouragement at each stage of this dissertation process. I could not have made it without you! Thank you! To my dissertation committee, Lanthan Camblin, Annette Hemmings, Heidi Andrade and Wayne Hall, thank you for being supportive of me as an individual and a researcher. I can only hope to pass on to my students the level of professionalism and support I received from each of you.

A shout out of thanks to my fellow sojourners, Sarah Hellmann, Lori Diehl, Billy Hensely, Angi Baker, Thembi Carr, Mark Mussman, Angela Arndt, Rob Kallmeyer and Dave Sacks for being the best support group one could ask for. I am proud to be part of the nerd herd!

To Tanmay and Dina, who became family to me during these years; thank you for being the very best! I am blessed to have you in my life! To my friend Sarah Hellman, thank you for celebrating with your paintings; my little accomplishments through this long journey.

To my mother, Wendy Nicholas, I am forever grateful. Thank you for your love, for the sacrifices you made to see me through college, and for instilling in me the value of education. A lifetime would be insufficient to say how much I am thankful!

To the Divine, whom I have come to know and experience in new and exciting ways through this doctoral journey, I am grateful for the gifts of life, love and opportunity.
# Table of Contents

Chapter 1: Introduction and Context ................................................................. 1

Chapter 2: A Review of Scholarly Discourses on Critical Thinking ................. 11

Chapter 3: Research Genre and Procedures .................................................... 48

Chapter 4: Faculty Conceptualizations of CT in the Natural Sciences – Findings .... 64

Chapter 5: Faculty Conceptualizations of CT in the Humanities – Findings ........... 96

Chapter 6: Faculty Approaches to Assessing CT in the Humanities and Natural Sciences ...... 132

Chapter 7: Faculty Conceptualizations of CT in the Natural Sciences and Humanities – Analysis and Findings ................................................................. 151

Chapter 8: Implications, Recommendations and Further Research ................. 170

References ........................................................................................................... 184

Appendix A: Semi-Structured Individual Interview Guide .................................. 199

Appendix B: Brief Participant Questionnaire ...................................................... 201

Appendix C: Focus Group Discussion Prompts .................................................. 202

Appendix D: Recruitment Letter for Individual Interviews ............................... 203

Appendix F: Recruitment Letter (Focus Group Discussion) ................................ 204

Appendix G: Adult Consent Form for Research .................................................. 205
Chapter 1

Introduction and Context

This study examined how faculty who teach general education courses in the natural sciences and humanities conceptualized critical thinking (CT) and assessed for it in their students. The study used in-depth interviews, focus group discussions and examined assessment artifacts using a sample of 14 faculty drawn from disciplines in the humanities and natural sciences. A qualitative, inductive, grounded theory framework was used to analyze and interpret data.

Statement of the Problem

When I considered the implementation of CT in higher education, I found two fundamental assumptions that had not been adequately vetted and questioned. The first assumption was that CT is discipline-general. The second was that the discipline-general approach which largely focused on a rationalistic conceptualization of CT was used as a valid measure of CT in all disciplines. There is need to move from philosophically defensible arguments on the discipline-generality of CT to an empirical examination of how faculty approached CT in the undergraduate classroom.

I also found that current discourses on CT focused heavily on identifying, defining and measuring the skills that make a critical thinker. As a result, the research on CT was dominated by quantitative methodologies. Given the contested nature of CT and the multiple levels of context in which CT operated in higher education. I saw a need to study CT using approaches that collected and analyzed a wide variety of data that is rich in context. It is my position that such an approach will reveal layers of context that cannot be unraveled using quantitative approaches.
In addition, faculty as a demographic has been ignored in the clamor to define, measure and assess CT, and to hold some entity within the university system accountable for the development of CT in students. Important questions that remain unanswered include, How do faculty conceptualize CT? What influences their understanding of the term? How do faculty make judgments on whether thought is critical? Are such conceptualizations different across disciplines? If they are, how are they different? Do faculty also take a discipline-general approach to teaching and assessing for CT as does the dominant assessment approach? These are pertinent questions to ask if we are going to hold faculty and institutions accountable based on the outcomes of discipline-general assessment tests and measures. They are important questions to ask if we are to retain the assumption in higher education that CT is discipline-general. They are essential questions that can throw light on why faculty approaches to assessing CT do not match the results of standardized, discipline-general tests (Escoe, Hall, & Nicholas, 2009). Yet, empirical research on how faculty from different disciplines conceptualized CT is scarce. The ones that exist are evaluative, or treat faculty as a bloc and do not take a multidisciplinary approach.

**Guiding Research Questions**

The following questions were addressed in this study:

1. How do faculty in the Humanities conceptualize critical thinking?
2. How do faculty in the Natural Sciences conceptualize critical thinking?
3. How do faculty in the Humanities and Natural Sciences assess CT in students within the context of general education?
4. How do faculty make judgments on what constitutes critical thinking?
Context

Universities in the United States have come to embrace the importance of critical thinking (CT) to the higher education process. The eighties and nineties saw CT receive a lot of attention because curriculum committees, school and college boards and publishing houses were interested in making it a campus wide, district wide or state wide requirement (Pithers & Soden, 2000). As early as 1980, The College Board made CT one among six basic skills needed for college (Ennis, 1985). Goals 2000, the educational reform legislation passed by President Clinton in 1994, brought to the forefront an effort to make American students good critical thinkers in order to compete on the globalized economic stage. Several leading universities like Harvard and the University of Virginia showcase CT in their mission statements (Zamon, 2008). Influential regional, national and professional accrediting agencies like the Council for Higher Education Accreditation (CHEA, 2010), the Western Association of Schools and Colleges (1990) and the North Central Association of Colleges and Schools (1992) require evidence of CT in graduates of the institutions that they accredit. Over the years, CT has become more integrated into higher education and in the current decade, it would be fair to say that interest in CT as an outcome of higher education has only intensified.

With all the attention that CT has received, one would imagine that it is a well established and articulated outcome of higher education. McBride, Xiang and Wittenburg (2002) identified numerous cases in the literature that raised concerns about the level of critical thinking in students. In a study, Casner-Lotto and Barrington (2006) found that around 70% of employers felt that new entrants to the workforce were ill-prepared to think critically. In recent national reports the AAC&U warned that college graduates are lacking in key skills like critical thinking (AAC&U, 2004; 2007). These findings are perplexing when one considers the facts that it is
difficult to find a university, college or department that does not claim to produce students who are able to think critically (Zamon, 2008).

A closer analysis revealed that CT is a term that is used by faculty, administrators, students, business, researchers, accrediting agencies, politicians, government and national governing bodies (Nicholas, Szabo & Weber; 2009). Nicholas et al. (2009) further pointed out that each of these players brings a unique dimension; and some, a vested interest to the term and it would be naïve to assume that the term has universal meaning. Hence it is important to decode and deconstruct the term and to establish meaning and connections within the multiple contexts in which CT is used in higher education.

**Personal context.**

A brief narrative of my own journey toward being interested in CT can provide both personal context and reflexivity. I left a corporate career as a software consultant to pursue a career of service. I sought to fulfill that goal through academic religious studies but I soon became disillusioned with all forms of organized religion. I began to question the absolutes that defined much of my life and realized that most of my valued beliefs were accepted as truth but never questioned.

My academic pursuits led me down the path of constructivism, interpretivism, post-modernism and phenomenology. As I applied these frameworks to my world view, I experienced cognitive disequilibrium. As I progressed in my doctoral program, I found that my paradigms were shifting rapidly but they were still very aligned to the person I wanted to be. Over my doctoral experience, I gravitated toward and began to identify, philosophically, with critical realism.
In many ways it provided a balance between my past and where I find myself at this point in time. In hind sight, I find that my personal journey involved me being a critical thinker, being open to question the assumptions of my world view and explore competing ideas and make changes to my world view. What I have become today or where this journey will lead me seems irrelevant in light of the liberation I experienced in being able to think for myself.

While thinking comes naturally to human beings, Paul, Elder, and Bartell (1997) pointed out that “human thinking left to itself often gravitates toward prejudice, over-generalization, common fallacies, self-deception, rigidity, and narrowness” (p. 2). Kroll (1992) identified a possible reason in that students are often more comfortable with “ignorant certainty” than they are with “intellectual confusion” (cited in King & Kitchener, 1994, p. 225). However, as Perkins and Tishman (2006) wrote, students do not learn content in ways that enable them to translate content into action. They concluded, “Learning that should matter, doesn’t” (p. 1).

My personal experience and aspirations as an educator are captured beautifully in a poem written by Nobel Laureate, Rabindranath Tagore. It has been my favorite since high school and I quote:

Where the mind is without fear and the head is held high;  
Where knowledge is free;  
Where the world has not been broken up into fragments  
By narrow domestic walls;  
Where words come out from the depth of truth;  
Where tireless striving stretches its arms towards perfection;  
Where the clear stream of reason has not lost its way  
Into the dreary desert sand of dead habit;  
Where the mind is led forward by thee  
Into ever-widening thought and action -  
Into that heaven of freedom, my Father, let my country awake. (Tagore, 1920)
As an educator, I work to challenge students to think critically on subject matter. I encourage them to explore and transgress intellectual boundaries. My goal is to encourage students to be thoughtful, caring human beings and then; teachers, scientists or mathematicians. Hence, how institutions of higher education approach CT triggers my personal attention. I am personally interested in making CT an outcome of higher education. Therefore broader questions like how faculty conceptualize, teach and assess CT and how institutions assess CT are important to me.

External context.

The Spellings Report (2006) brought the spotlight of accountability to higher education just as No Child Left Behind brought accountability to PK-12 education. Three requirements of the Report emerged as points of interest for this study, (a) the measurement of student outcomes like CT; (b) institutional accountability; and (c) institutional comparability. The Voluntary System of Accountability (VSA) which emerged as the Academy’s response to the Spelling’s Report called for universities to voluntarily disclose gains in CT among other student learning outcomes to circumvent direct government intervention.

Universities are to use a common reporting method called College Portrait and are to publish the results of institutional student learning outcomes on the university’s website (NASULGC, 2007). To put into perspective the scope and seriousness of this endeavor, currently 329 public institutions of higher education have responded to the VSA’s call for accountability. Together, these institutions enroll 7.5 million students, and award 70% of bachelor's degrees in the United States each year (VSA, 2008).

The VSA undertook an examination of instruments that were already available to measure student outcomes like CT. After its study, the VSA recommended three standardized
tools which it felt would help achieve some level of comparability in how student outcomes are assessed and reported. VSA institutions could choose any one of these instruments to measure student outcomes. This issue is being hotly debated on the national stage; nonetheless, it is also being implemented (VSA, 2008).

This study was conceived at a time when I was tasked with conducting and interpreting the intriguing outcome of an institutional study. That study was a pilot to examine how the VSA’s recommendations could be applied to our institution. In the study, Escoe, Hall and Nicholas (2009) compared two contrasting methods of assessing CT, the Collegiate Learning Assessment (CLA) test and the Valid Assessment of Learning in Undergraduate Education (VALUE) rubrics using the same sample of students. The CLA is a VSA recommended, standardized, 90 minute test that measures discipline-general CT. The second assessment approach used a faculty developed, VALUE rubric for CT that was sponsored by the AAC&U which also claimed to measure trans-disciplinary CT (AAC&U, n. d.). The rubric was applied by faculty to student artifacts that emerged from the classroom. The study concluded that there was little or no correlation at the .05 level between the results of the faculty driven assessment and the CLA when assessing CT.

This finding intrigued us as a research team, especially when we considered that the outcomes of assessments developed and applied by faculty did not match with an approach that the VSA had recommended to hold institutions accountable for the development of CT in undergraduate students. After closely analyzing the data for several weeks, we arrived at several possibilities for the lack of correlation between the two assessment approaches. These findings were presented at national and international conferences (Escoe, Hall, & Nicholas, 2009) and discussed in detail in a white paper.
An interesting vignette that occurred during the study, which we did not discuss in the original manuscript, raised questions that set me directly on the path to this study. During the study researchers had each student artifact graded by two faculty members using the VALUE critical thinking rubric developed by the AAC&U. Our faculty pool of raters was drawn from different liberal arts disciplines.

When we were examining the outcomes of faculty assessment for inter-rater reliability, one student’s scores raised red-flags. A faculty member rated the student artifact as displaying very high critical thinking while the other rated the same artifact as displaying very low critical thinking. We sat in with the two faculty raters and discussed how they graded the artifact. In the round-table discussions to establish inter-rater reliability, hinged an important clue.

The student had written a proposal to make a trip to Mexico where she wanted to interview a Catholic nun on the effects of NAFTA on Mexican farmers. One rater, a quantitative economist, said she felt the student displayed poor critical thinking as the premise on which her experiment was based, was flawed. She retorted, “as much as I respect a Catholic nun, I will not go to her to analyze or discuss economics.” The other rater, a faculty who taught in education and studied critical theory, held that the student displayed high CT as she was planning on getting a fresh perspective on NAFTA. The Catholic nun, in her experiences with rural Mexican farmers, could reveal a perspective that had not yet been heard and one that was based on personal experiences of real people.

This research experience triggered two processes for me. First, it brought institutional lenses to my interest in CT. Second, it made me wonder how two faculty members could use the same rubric on the same student artifact and reach different conclusions even after being trained on how to use the rubric. The lenses that faculty wore determined not just the level of CT, but
more importantly it seemed, whether the premise of thinking was critical or not. It became clear
to me that the assumptions with which one approached CT may be as important as the actual
processes of critical thinking.

Statement of Positionality

Implicit theories and preconceptions, lead us to examine specific research questions
within specific contexts and participants (Rein & Schon, 1977). The implicit theory that led me
to this study was based on the assumption that the differences in how faculty conceptualize and
assess for CT were influenced by their disciplinary leanings.

Rationale for the Study

If the problematic areas identified in the discourses on CT remain unexamined, we run
the risk of continuing to do injustice to the aspirations of some disciplines, students and faculty.
Assumptions that underlie the general education curriculum and assessment of CT will remain
unexamined. Graver still, we will continue to conduct meaningless exercises at the program,
university and national levels that have no real bearing on whether and how students learn and
how faculty teach and assess CT in the classroom.

In an attempt to present empirical data on these unanswered questions, this study
examined how faculty conceptualized CT. The study adopted a strong disciplinary approach
focusing on disciplines in the humanities and natural sciences. It examined the intricacies with
which faculty construct their understandings of the term and the elements that influenced their
approach. It studied faculty conceptualizations in light of the approach that they adopted to
assessment. Thereby providing valuable insights that can help examine whether and how faculty
approaches are aligned with institutional practices. The study used qualitative, inductive, and
interpretivist approaches to study CT within the context of how faculty conceptualized the term.
The study took an exploratory approach to study faculty and hence has not used an operational definition of CT.

**Significance of the Study**

This study is of significance to campus assessment personnel charged with selecting a tool of assessment for general education programs and VSA purposes. Given the high stakes, institutions are going to be interested in how their students perform so as to be competitive with the stakeholders in higher education. It also means that university and college administrators will be interested in maintaining or improving their institutional scores by developing systemic curricular and pedagogical interventions across their institutions. The findings of this study also have implications for conceptual understandings of CT, faculty development and the current model recommended by the Voluntary System of Accountability (VSA) for the assessment of CT.
Chapter 2
A Review of Scholarly Discourses on Critical Thinking

Introduction

This research endeavor is situated within scholarly discourses in several bodies of literature. In this chapter, I will review previous scholarship on critical thinking, identify areas in which further understanding is needed, and establish a framework for the current study. In order to capture the complexity of critical thinking (CT) as a concept, the diversity of views on it and the multiple contexts in which it operates in higher education, this chapter is divided into two sections: Discourses on CT as a concept and Discourses on the application of CT within higher education and general education programs in particular.

In looking at CT as a concept, I have covered discourses on (a) definitions of critical thinking; (b) CT and other related higher order thinking skills; (c) schools of thought on CT; (d) components of CT; (e) CT and personal epistemology. As a goal and outcome of higher education, I discussed (a) national efforts to assess CT as an outcome; (b) CT and the General Education Program; (c) curricular and assessment approaches used in general education; (d) the question, is CT discipline-general or discipline specific; (d) CT in the disciplines; and (e) research on CT and faculty in higher education. I have also outlined problematic areas in the above discourses and established a rationale for the study and its design. The examination of the discourses in these categories will help frame the context and facilitate the deployment of this dissertation study.
Definitions of Critical Thinking

Historically, CT as a concept has had strong roots in the discipline of philosophy (Battersby, 1989). As an outgrowth of philosophy, CT was bound up in the Socratic method and was grounded in a literature that was theoretical in nature. As it pertains to the field of cognition, CT has associations with the discipline of psychology. In the hands of psychologists, CT acquired a strong cognitive foundation with measurable dimensions. As a pedagogical aim and outcome, researchers and educators have developed multiple applicational models and assessment tools (Facione, 1990; Paul & Elder, 2003; Perkins, Jay, & Tishman, 1993; Watson & Glaser, 1980). The intense interest in CT by multiple stakeholders combined with the multiplicity of perspective has meant that the evolution of CT as a concept is the result of a complex amalgamation of multiple and often competing ideas and philosophies (Nicholas, Szabo & Weber, 2009). As Angeli (1999) described it, the field developed from debates, polemics, conflicting theorizations and an assortment of experimental implementations.

Definitions of critical thinking vary in terms of the nature, scope and purpose of CT. As a student of Greek, I examined the etymology of the word “critical”. I found that it was derived from two Greek root words κριτικός and κριτήριον which when transliterated read kriticos and kriterion. Kriticos translates in English to the ability to judge or discern and kriterion, to a means or standard for judging (Bauer & Danker, 2001). Hence it would be fair to say that the word critical means the ability to judge or discern based on a standard.

Nonetheless, at the very root of the term, I found myself asking questions like what standards and whose standards. Most scholars agree that CT is most visible when thinking involves situations where fact has not been or cannot be established. An example of critical thinking would be the thinking required of a member on a jury, examining the innocence or guilt
of an individual in a criminal case. In this example, some societies have evolved laws and constitutions to establish standards to convict or absolve a suspect.

While it is clear that critical thinking would be required of a member on a judicial inquiry, the acceptable standards are established by the presence of laws. Even then, as we see in judicial cases, these standards are subject to interpretation by judges, and defense and prosecution lawyers. Further, whether a jury thought critically based on evidence presented and the standards of the law, is also subject to interpretation. This is on account of the fact that the values that define what is fair or unfair could differ depending on vantage point, bias, intent and motive of those who interpret it or of those that evaluate the decision of a jury. These dilemmas were epitomized in the recently concluded Casey Anthony trial that captured the attention of this nation. Therefore at the crux of defining CT, I was faced with questions that lent themselves to multiple interpretations.

A brief analysis of several definitions of CT by theorists who have shaped the field will help achieve a better understanding of the term. My goal is to glean important elements of CT, to contrast the various definitions and to highlight difficulties in defining CT. John Dewey who is regarded as the father of modern critical thinking (Fisher, 2001) defined reflective thinking as an “active, persistent, and careful consideration of a belief or supposed form of knowledge in the light of the grounds which support it and further conclusions to which it tends” (Dewey, 1933).

**Judiciousness.**

Dewey’s definition stated that the conclusions drawn as a result of thinking critically should be reasonable in the light of the evidence used to support them. This aspect of Dewey’s definition brings to the forefront the judicious nature of critical thinking. It would be fair to state that judiciousness is a widely accepted trait of CT. Paul and Elder (2006) wrote that critical
thinking deals with the mind’s judiciousness and ability to make fair judgments that are grounded in evidence. While few would argue against judiciousness being part of CT, the problem arises with what theorists attribute as contributing to the judiciousness of the mind.

Some theorists and researchers have held that CT in essence, is logical and rational thinking (Paul & Elder, 1999; 2003). Halpern’s (1996) definition argued in favor of a cognitive basis, “Critical thinking is the use of those cognitive skills or strategies that increase the probability of a desired outcome” (p. 6). Ennis (2007) identified conceptually identifiable dimensions of CT that highlight validity based on deductive methods of reasoning. Others like Serrat (2011) have closely associated CT with the scientific method of inquiry. CT provided a framework for an organized, systematic and mathematical process which could help determine a cause-and-effect relationship using deductive, analytic processes.

Reminiscent of Descartes, they favor rationality as a valued basis for critical thought. Philosophically, their definitions can be qualitatively differentiated but they lean heavily toward realism and prefer the adoption of either positivist or empirical means to establish valid understandings of reality. However, to view CT solely as a product of rationality, would confine its scope to just the cognitive realm.

In casting their views on the rationalistic tradition in CT, Papastephanou and Charoula (2007) classified into a single group, theorists who favored rationality with those who favored reasoning as part of CT. I need to mark distinctions on this count as I do not necessarily agree with their classification. Rationality, I argue, focuses exclusively on applying cognitive, deductive and mathematical approaches in dealing with evidence. It also represents an exclusive standard by which thinking is assessed. Reasoning is a more general term that represents a process or act. It encompasses cognitive rationality, intuition, emotions or other sensory
Reason is expressed in multiple languages and its means of justification depend on the context of the thinker and the context in which thinking is done. I argue that reasoning as defined above is an integral part of CT irrespective of the approach one ascribes to it. Hence my critique is not directed at those that include reason as part of CT as much as it is to those who focus exclusively on rationality. McPeck (1981) warned, “While CT is perfectly compatible with rationality and with reasoning generally, we should not regard the terms as equivalent” (p.12).

Blaise Pascal, the famous French philosopher who was known to have embraced rationalism, also acknowledged the limitations of rationality to determine major truths. Translated from French, he wrote his book Pensées, “The heart has its reasons, which reason does not know.” Echoing similar tones, feminist writer Gilligan (1993) broke new ground when she pointed out that research like Kholberg’s (1984) study on moral development failed to even consider the views of women. Integral to Gilligan’s argument, was that there are alternative ways of knowing beyond a cognitive, rationalistic approach. Her findings, resulted in more research from writers like Bailin, (1993, 2002); Thayer-Bacon (1993) who presented alternative ways of knowing that valued both subjectivity and rationality. Shor (1992) argued convincingly that critical thinking is simultaneously a cognitive and affective activity, that it is emotional as well as rational.

The tension, in my opinion, arises when the rationalistic approach is treated as mutually exclusive from the critical philosophical approach. The excessive focus on rationality assumes that the highest form of knowing is based on reason alone. While it makes for good theory, the reduction of CT to rationality and objective truth can lead to binary ways of thinking and ignores the realities and limitations that context places on thinking. Dewey also cautioned against unexamined reliance on intuition (Walthew, 2004). An exclusive focus on emotions, feeling and
other subjective ways of knowing can at best lead to misguided enthusiasm and at worst, to unexamined or unfounded assumptions and judgments. Whichever way one approaches judiciousness as a characteristic of CT, it raises contentious questions on the scope of CT and has implications on the evaluation of CT as an outcome.

**Task oriented/dispositions.**

In an attempt to define CT as a process that leads to a result or outcome, some theorists have developed a task oriented approach to CT. Ennis (1993) held that critical thinking involved reasonable and reflective thinking, focusing on a task, people or a belief. This approach of framing CT as a task has several implications. First, it called for the articulation of a defined process for CT. Second, it led to the development of multiple taxonomies of CT skills that were involved in the process. Third, it contributed to understanding CT as a developmental process.

As a process, Ennis (2007) identified three conceptually identifiable dimensions of CT – (a) the ability to judge the credibility of sources and observations, (b) whether a line of reasoning is deductively valid, and (c) whether a best explanation argument yields proof beyond doubt (or less). In a seminal study on critical thinking, Glaser (1985) defined critical thinking as involving three things – being disposed to thoughtfully consider problems and subjects that one experiences, to possess knowledge of how to reason logically, and the skill to make application of such knowledge and experience. What emerges from these processes is a strong dependence on rationalistic processes of a premise leading to a definitive conclusion.

Psychologists like Halpern (1989) and Smith (2001) chose to articulate the tasks involved in the CT process. Halpern held that CT was the thinking involved in problem solving, formulating inferences and decision making. Smith (2001) argued that “Critical thinking is either a form of problem solving, a part of problem solving, or should include problem solving” (p.
What these theorists achieved was the externalization of CT as a cognitive rational process. As a natural outgrowth of the epistemic purpose, some theorists have felt the need to explicitly state the specific skills involved in CT (Facione, 1990; Watson & Glaser, 1980). Their assumption being that if students learned the skills and process of CT, they could become critical thinkers. This in turn, led to the development of a number of standardized tests that assessed for the cognitive skills of CT using multiple choice test formats.

The approach to standardize both the process and skills of CT gave way to critique. Balin (2002) warned that it would facilitate the popularization of a set of skills or a specific process as having universal properties and applicability. More dangerous, in my opinion, is the fact that most of these theorists have developed statistical reliability for their tests, but hardly ever come up with statistics on the validity of the inferences made based on their measures. Reliability in statistics only means that if a person takes the tests several times, the outcome would be the same. I could very well give a student a reading test to assess writing and if the student scored the same score each time he/she took the test, it could be deemed a reliable measure of writing. Further, all of the instruments that claim to measure CT have commercially branded their tests as universal measures of CT. Such titles are deceptive and have a tendency to become pervasive. As evident with standardized CT tests, they have come to be used to define the very essence of CT rather than the specific processes or skills developed by a specific theorist or researcher for a specific purpose.

From an educational perspective, Perkins, Jay, and Tishman (1993), Winch (2004), Bain (2004) and Facione (1990) pointed out from their research that an exclusive focus on the skills of CT does not guarantee that an individual will always think critically on all matters. These writers
argued for importance to be accorded to what they called the dispositions of CT. Dewey (1922) too, recognized the need for a dispositional answer when he wrote:

We need a word to express the kind of human activity which is influenced by prior activity and in that sense acquired; which contains within itself a certain ordering or systematization of minor elements of action; which is projective, dynamic in quality, ready for overt manifestation; and which is operative in some subdued subordinate form even when not obviously dominating activity. (p. 41)

The APA (1990) held that the disposition toward critical thinking is a tendency that can trigger one to use critical thinking skills. Facione, Facione, and Giancarlo (2000) wrote that the overall disposition toward CT is the consistent internal motivation to engage problems and make decisions using CT. Perkins and Tishman (2006) defined thinking dispositions as “broad characterological tendencies that influence how they (individuals) use their knowledge and skills...how people think, and learn and how they use what they learn” (p. 3). They argued that critical thinking dispositions are non-intellective factors in the assessment of CT ability. These definitions differ in establishing the role of dispositions in critical thinking and this theme will be explored further when I discuss the components of CT later in this chapter.

**Evaluative**

Another important element that emerged from the literature is that CT is an evaluative process. Dewey’s (1933) definition qualifies CT as an active process as opposed to a passive approach to thinking. Some definitions have focused on evaluation of self; making evaluation a reflective introspective process that leads to self-regulation. Others focus on evaluation as directed at external elements like evidence or reasons. Still others see it as an interaction or coming together of evaluation directed at self and external elements.
Proulx (2004) focused on the outward direction of CT when he held that critical thinking requires one to evaluate the credibility of information and the effectiveness of evidence. Bailin, Case, Coombs, and Daniels (1999) too defined CT as “responsible assessment of reasons and arguments” (p. 289). They argued that such thinking was to be accompanied by “responsible deliberation.” The evaluation of evidence involved exploring multiple perspectives before reaching a responsible conclusion. It involved engaging ideas beyond ones current world view or personal epistemology and seeking to explain discordant or conflicting evidence.

Paul, Binker, Adamson, and Martin (1989) pointed to the evaluative, introspective nature of CT when they wrote that CT involved thinking about thinking while one is thinking. The underlying assumption is that CT involved questioning assumptions that underlie one’s own thinking. Elder and Paul (1994) articulated the introspective element as “the ability of thinkers to take charge of their own thinking.” (pp. 34-35). Newman (1996) in his book, *The Idea of a University*, beautifully captured the coming together of internally and externally directed evaluative processes of thinking when he wrote, that the mind must make an equal effort to meet whatever comes at it from without.

This discussion becomes litigious because most theorists argue that the evaluative process, whether directed internally or externally, should lead to some form of outcome. The value laden nature of the outcome of the evaluative process is borne out when Halpern (1996) wrote that critical thinking can be defined as directed thinking because it focuses on a desired outcome. Halpern’s (1996) notion of a desired outcome raises contentious questions at multiple levels. Central to this discussion is what I call the *problem of judgment* – who decides what is desired and by whose standards is a desired outcome to be assessed. Further, as Papastephanou
and Charoula (2007) rightly questioned, are there “universally valid criteriology” (p. 605) to assess the outcome of CT?

Not surprisingly, there are differences of opinion on what should be the outcome of CT. Ennis (2007) summarized the epistemic purpose of CT as the search for the truth or the closest approximation of it. He held that the skills and dispositions of CT promote the pursuit of truth and should not be interpreted to mean that the critical thinking process always results in the truth. Papastephanou and Charoula (2007) argued that such an approach assumes that there are universal methodological and criteriological considerations that can lead one to what Apel (1998) described as objective truth. Truth here is defined as having properties of mathematical or statistical validity with elements of objectivity; just as in the case of the simple mathematical procedure $2 + 2 = 4$. The assumption of such notions of truth is that given a set of variables and a body of evidence, a good critical thinker can arrive at the truth. Consequently, theorists who argue that objective truth should be the outcome of CT have placed importance on the ability of critically thinking individuals to arrive at this truth value through the practice of CT skills.

My objection to a strict adherence to positivistic notions of objective truth as the outcome of CT is that it ignores the complexity of the social and physical world to which CT must be applied. It overlooks truths that are developed out of phenomenological, constructivist understandings of the world or of meaning, and how meaning is constructed in context. Touchy subjects like abortion, capital punishment, gender equality, and gay marriage have been hotly debated over decades with no easy resolution. What does the notion of CT as leading to objective truth have to proffer such debates? In my estimate, the approach diminishes the critical component of thinking and narrows the scope of the term. It leaves unanswered questions on who will be arbitrators of the truth, and of power and authority, which deeply concern critical
theorists and social reformers. From an academic perspective, this view ignores the inconclusive nature of knowledge in many academic domains, the existence of multiple or competing truths, and assigns a negligible role to ambiguity in CT.

Dewey’s use of words like “persistent” and “careful” brings to focus the reflective nature of CT. Reflection in critical thinking provides scope for the examination of multiple points of view and the examination of one’s own assumptions. Influenced by the writings of critical theorists, others like Forneris (2004), and Rudd, Baker, and Hoover (2000) concluded that CT in practice required reflection. In the same vein, Garside (1996) defined critical thinking as ‘a controlled sense of skepticism’ (cited in Browne & Freeman, 2000). Perkins (1989) held that choosing what to believe wisely facilitates development of sound belief and conduct. He argued that the beliefs held by an individual and the inferences and attitudes that follow such beliefs depend in part on an individual’s reasoning about the basis for holding such beliefs. Therefore as a skeptical process, these theorists focus on multiple ways of knowing with a goal to deconstruct established principles and current ways of knowing. Tsui (2003) held that critical thinking requires the presence of mind to “assess and scrutinize ‘knowledge’ prior to its consumption” (p. 328).

This approach to CT makes room for ambiguity and not knowing, an outcome of CT. It also holds that good critical thinkers deconstruct and question truth rather than perpetuate current knowledge and ways of knowing. Papastephanou and Charoula (2007) described it as the “aporetic” (p. 604) element of CT. When seen as aporetic, CT focuses on doubting and questioning and being comfortable with ambiguity and not knowing. Leading psychologists like Sternberg (2010) and Bok (2007) in the later parts of their celebrated careers called for schools to teach for creativity and for making students comfortable with ambiguity.
Critical thinking when defined as aporia is not without its limitations. It is difficult to articulate and assess. The aporetic process is tiring and has the potential to destabilize the theoretical equilibrium of those who employ it. Winch (2004) argued that educators should be aware that critical thinking has the potential to bring about anarchy, cynicism and instability. When used as a tool for social change, it could lead to revolutions and the inability to change some structures, which in turn, could lead to cynicism. Hinchey (2004) and Giroux (2006) wisely advised educators to link the language of critique with the language of hope and to be aware that critique and hope must inform each other so as to avoid debilitating cynicism.

**Role of Context in CT**

Theorists and researchers who have defined CT as a purely rationalistic, cognitive skill have been criticized for ignoring the role of context in critical thinking. Kuhn (1991) wrote that critical thinking involved the skill of argument and that the skill is evident when thinking is conceptualized through reasoning within a specific social environment. These writers argued that CT cannot be thought of as operating in a vacuum. It is not a valueless process leading to objective truth. In each of the roles that CT operates, Perkins (1989) argued that we should examine both the context of thinking and outcomes of the process. He argued that they should be seen in shared light.

Pithers and Soden (2000) elaborated that critical thinking is influenced by the “context and culture in which it is situated” (p. 246). Choules (2007) examined context from two perspectives – the context of the individual and that of the society from which the individual comes. While the above approaches on context are necessary for a complete discussion on CT, they focus on the context of the thinker and ignore the context of the evaluator of CT. Within the context of higher education, the context of the evaluator has two implications. First, given the
disciplinary diversity in higher education, the question that arises is whether CT is discipline
specific or discipline-general. Second, it calls for an examination on how faculty approach the
teaching and assessment of CT. Therefore this study is designed as a response to lack of research
on the context of faculty as evaluators of CT in undergraduate students.

**CT and Related Constructs**

The intense theorizing and research into CT also helped clearly differentiate or create
linkages between related constructs like thinking well, thinking smart, good thinking, creative
thinking, higher order thinking and critical thinking. While van Gelder (2005) and Paul and
Elder, (2006) held that CT is a higher order skill, the APA (1990) warned that “Not every useful
cognitive process should be thought of as CT. Not every valuable thinking skill is CT” (p. 5).
Paul and Elder (2006) made a distinction between creative thinking and critical thinking, but see
them as two sides to the same coin. They hold that creative thinking deals with the mind’s
generative power. By this, they refer to the creative faculties of the mind. They hold that critical
thinking deals with the mind’s judiciousness and ability to make fair judgments that are
grounded in evidence. However, as a process, they see creative and critical thinking operating as
one. Pithers and Soden (2000) write, “Good thinking and thinking well are commonly used terms
bound up with what is called critical thinking” (p. 237). The APA (1990) held, “CT is one among
a family of closely related forms of higher-order thinking, along with, for example, problem-
solving, decision-making and creative thinking” (p. 5). Clearly, the theorists have sought to carve
out a distinct domain for CT while admitting how interconnected CT is with other related
constructs.
Schools of Thought on Critical Thinking

Multiple schools of thought have centered on the philosophical and psychological underpinnings of CT as a concept. In order to mark distinctions among schools of thought in CT, I will categorize them using three paradigms identified by Papastephanou and Charoula (2007) - the rationalistic, the skilled, and the critical philosophical approaches to CT. I will also highlight characteristics of what Phillips and Bond (2004) called the “generic” brand of CT. These categorizations were selected as they capture the broadest spectrum of opinion on CT and included the dominant schools that have influenced the application of CT in higher education. In addition, they highlight the philosophical affiliation of each school which suits the analysis of data in this dissertation.

The rationalistic approach to CT.

Theorists and researchers in the rationalistic school (Ennis, 1987; Glaser, 1985; McPeck, 1981, 1990; Siegel, 1988, 1992), see CT as the product of rationality. While definitions from each proponent in this school would differ, in terms of scope or components that each definition highlights, the overriding assumption that brings these theorists together is that the judiciousness of the mind, which is characteristic of a critical thinker, is always the result of rationality.

We can gain a deeper understanding of the rationalistic approach by gleaning from its critics. Papastephanou and Charoula argued that the rationalist perspective distances itself most from emotions, context and prejudices and aligns itself most with “universally valid criteriology” (2007, p. 605). Such conceptualizations also lead to a heavy emphasis on the cognitive processes of CT while ignoring contextual, dispositional and affective considerations.

This school has also been criticized as having a tendency to over simplify CT to a narrow set of skills. Walters (1990) leveled a scathing blow to approaches that treat CT as a “calculus of
justification” (p. 451). He argued that it forces students to view CT as pertaining to just the rational and logical. This “analytic reductionism” (p. 451) he wrote, compels students to reduce any problem into either deductive or inductive parts. Walters termed this as a form of “vulcanization” (1990, p. 451) of students.

The skilled or technicist approach to CT.

As a natural outgrowth of the rationalistic approach to CT, some theorists have felt the need to itemize the specific skills involved in CT. Papastephanou and Charoula (2007) categorized it as the skilled or technicist approach to CT. Bailin (2002) pointed out that when conceptualizing CT as a process it could mean a mental process or a series of procedural steps. The implication within this school of thought is that there are a series of procedural steps that when followed will lead to truth. Proponents of this approach hold that individuals can be trained to perform the skills of CT and thereby become critical thinkers. The focus is so exclusively on the acquisition of skills and the mastery of the procedure that it ignores the role of critique, context or deep reflection.

The operationalization of CT as a set of cognitive skills gave impetus to endeavors that assess and measure CT as a skilled outcome. The assessment model that logically grew from this tradition focused heavily on CT skills like logic, analysis, inference and deduction that lead to a desired conclusion. As pointed out earlier, the desired outcome of the CT process in this school of thought was to find truth. When presented with similar evidence, there was one conclusion to be derived and this ability was measurable. This led to the mushrooming of several standardized, multiple choice tests to assess for the skills of CT.

Balin (2002) critiqued the assumption of the approach that framed CT as purely skilled or process-based. She argued that it standardized the process of CT and assumed the same process
can be applied to multiple situations irrespective of context. Papastephanou and Charoula (2007) also critiqued the approach for its “absolutization of performativity and outcomes” (p. 604). Peters (2005) argued that such a model creates reflective, cautious and entrepreneurial minds but questioned whether it creates critical minds.

**The generic skill approach to CT.**

This school is a hybrid of the rationalistic and skilled schools of thought. As a generic skill, CT is defined as a collection of skills that focus heavily on rationality (Elder & Paul, 2004; Ennis, 1985; Facione, 1990; Glaser, 1985; Halpern, 1996; Swartz, 1987). Protagonists of generalist school held that, when learned, the body of rationalistic skills that they associated with CT when learned could be applied across domains, contexts and disciplines. Within academic contexts, this brand of CT has come to be called discipline-general CT.

An integral assumption in arguing that CT is discipline-general is that it can be taught independent of content (Ennis, 1989). It relies heavily on logical processes that examine relationships between variables. Ennis (1989) provided the following example: “All As are Bs implies that if something is not a B, then it is not an A” (p.4). Logically then, many in this tradition hold that critical thinking can be taught effectively outside the context of disciplinary content. Critics argue that this assumption effectively achieves a divorce between CT and context, rendering the CT process impotent. The generic approach has dominated the discourse on critical thinking (Papastephanou & Charoula, 2007; Peters, 2005) and its application in higher education. I will attempt a critique of this school when I discuss the question, “Is CT discipline-general or discipline specific?”
The critical philosophical approach to CT.

This school emerged as a reaction to rationalistic and skilled interpretations of CT that have dominated the literature and the application of CT. A dominant position in this school of thought is held by researchers like Carol Gilligan and critical theorists like Raymond Williams. It is no surprise that the proponents in the critical philosophical tradition have vehemently opposed those in the camp who narrowly focus on the role of rationality and skill in CT. They are keen to distance the judiciousness that is characteristic of CT from objective rationality. They argue in favor of valuing multiple ways of knowing beyond rationality. Halx and Reybold (2005) summarized this school as also focusing on the uncertainty of knowledge and knowing. As a result, CT as a product from this tradition is more nuanced in its position on standards and truth than the rationalist and technicist tradition. It holds that good critical thinkers deconstruct and question truth rather than perpetuate current knowledge and ways of knowing.

Components of Critical Thinking

Despite the spectrum of opinion on the definition of CT, there appears to be a broad acceptance that CT is a multidimensional construct (Ennis, 2007). Gleaning from the literature, theorists generally associate cognitive skills and cognitive and affective dispositions as components of CT. Recently, theorists like (Nieto & Saiz, 2011) made a case for the examination of the role of epistemology in CT and for the addition of epistemology as a component of CT. I will undertake a brief survey of the current discourses surrounding the components of CT and establish some operational definitions on epistemology to help frame the findings of this study.

Critical thinking skills.

The APA (1990), through the deliberation of a body of experts, listed the following cognitive skills as core or central to CT: (a) interpretation, (b) analysis, (c) evaluation, (d)
inference, (e) explanation and (f) self-regulation. Based on the experts’ opinion, the skill of interpretation involved the ability to understand and express the meaning of experiences, situations and data. Analysis involved identifying relationships among related constructs that express an idea or belief. Evaluation referred to the ability to judge the veracity of information. Inference was defined as the ability to develop hypotheses and arrive at logical conclusions. Explanation was the ability to express one’s stand so that it was justified in the light of the evidence considered and the methods used in the investigation. Self-regulation was the ability to control and regulate one’s own thinking. Facione et al. (2000) held that CT employs the cognitive skills of interpretation, analysis, inference, explanation, evaluation and self-regulation. Several other theorists like Watson and Glaser (1980) have developed similar taxonomies of CT skills.

The APA (1990) pointed out that it was not necessary for a person to possess all the above skills to be a critical thinker. At the same time, the mere possession of these skills does not also make a critical thinker. Being a good critical thinker involves a dispositional dimension. Ennis (1986) popularized the notion that thinking involved more than just a cognitive aspect. He postulated a taxonomy of critical thinking skills alongside a taxonomy of thinking dispositions. Dewey (1933), Watson and Glaser (1980), Langer (1980, 1989), Siegel (1988), Paul (1990), APA (1990), Stanovich (1994), Facione, Sanchez, Facione, and Gainen (1995), Perkins et al. (1993), Pithers and Soden (2000), through their theoretical categorizations and research, affirmed that CT involves a set of cognitive skills, competencies and dispositions.

**Critical thinking dispositions.**

The term disposition in general parlance refers to the propensity to be attracted to or repelled from something or someone. The APA (1990) held that the disposition toward critical
thinking is a tendency that can trigger one to use critical thinking skills. Facione et al. (2000) wrote that the overall disposition toward CT is the consistent internal motivation to engage problems and make decisions by using CT. In their understanding, CT dispositions involved affective elements that led to the acquisition of CT skills. Perkins and Tishman (2006) defined thinking dispositions as “broad characterological tendencies that influence how they (individuals) use their knowledge and skills…how people think, and learn and how they use what they learn” (p. 3). They argue that critical thinking dispositions are non-intellective factors in the assessment of CT ability. These definitions differ in establishing the scope of CT dispositions.

The APA (1990) held that dispositions were of two types – cognitive dispositions and affective dispositions. The multi-disciplinary experts on the APA panel were split 61-39 percent on the role that each disposition type played in understanding CT. However, there was unanimity in the panel that the affective dispositions of CT are required to make a “good critical thinker.” This is solely based on the ability to make effective use of CT skills.

This discussion highlights the important role of the dispositional dimension as a component of CT. Hudgins, Riesenmy, Ebel, and Edelman (1989) held that the aim of teaching children to become critical thinkers is to develop a disposition to do so. Internal and external motivation or lack thereof can trigger or stifle the use and application of the CT skills that an individual possesses (Facione et al., 2000). The effective coming together of knowledge and CT skill requires a dispositional capability. Education for lifelong learning therefore has to attend to the cultivation of positive learning dispositions, as well as of effective learning skills (Carr & Claxton, 2002). Nearly a century ago Dewey, in How We Think, captured the significance of intellectual dispositions as follows: “If we were compelled to make a choice between these
personal attributes and knowledge about the principles of logical reasoning together with some
degree of technical skill in manipulating special logical processes, we should decide for the
former” (1933, p. 34).

The problem with dispositions is that they are difficult to assess using traditional means
of multiple choice tests of cognition. The only measure of dispositions - the California Critical
Thinking Dispositions Inventory (CCTDI) developed by Facione and Facione (1992) is
measured through a self report of attitudes, opinions and beliefs. It does not measure actual
‘ability’ to use CT as postulated by Ennis (1985) or Perkins et al. (1993) in their triadic model of
CT dispositions. There certainly is need for more research on this front.

Writing from a contemporary stance, Facione et al., (2000) held that the empirical results
of studies conducted revealed that an effective approach to teaching for and about thinking in
schools and professional development programs must include strategies for building intellectual
character rather than relying exclusively on strengthening cognitive skills. A more detailed
review and critique of the models of CT dispositions and the relationship between skills and
dispositions may be found in my qualifying paper (Nicholas, 2009).

**Critical Thinking and Personal Epistemology**

After analyzing personal and disciplinary conceptualizations of CT of faculty using the
framework of definitions, components (skills and dispositions) discussed above, I concluded that
the current framework in the research literature was inadequate to explain some aspects of the
data I was analyzing. Hence, I began to search for answers outside the critical thinking literature.
After discussion with a colleague who researches personal epistemology, and after reading a few
of the articles he recommended, I found a credible lead. I theorized that studies in personal
epistemology could explain aspects of CT that emerged from the data. Looking through research
databases for literature on CT and epistemology, I came upon a recently published theoretical article by Nieto and Saiz, (2011) calling for an expansion of the components of CT to include skills, dispositions and epistemology on CT. However, she adopted a theoretical stance and did not present empirical evidence for her arguments.

Battersby (1989), too, published a theoretical article arguing that CT is applied epistemology. She argued that CT as a philosophical concept is governed more by the rules of epistemology than by logic. Kuhn and Weinstock (2002) affirmed that a connection between the literature on CT and epistemology existed at the conceptual level. Nieto and Saiz (2011) also called for more empirical research into the role that epistemology played in critical thinking. Encouraged by these theoretical works, I applied an additional framework to my findings.

I first sought to understand the personal epistemology literature and find operational terms that could provide me with points of reference. Epistemology as Crotty’s (2003) defined it is a branch of philosophy that examines the nature of knowledge and the association between knowledge and the knower. Personal epistemology is an applied branch of epistemology that refers to an “individual’s beliefs about the study of knowledge and knowing” (Greene, Azevedo & Torney-Purta, 2008). It is a term used to define the beliefs that individuals hold on the nature of knowledge and is concerned with “common questions about what we should believe” (Battersby, 1989, p. 91). Personal epistemology is also concerned with “what would count as sufficient justification for a belief to be the basis of a knowledge claim” (Battersby, 1989, p. 96) and how knowledge claims can be justified (Williams, 2001). Other aspects of personal epistemology that are of interest to this study are captured in the writings of Buehl and Alexander (2001) and, Muis, Bendixen, and Haerle, (2006). According to them, when studying knowledge in academic contexts, personal epistemology is concerned with the nature of
knowledge, the array of beliefs that people hold on the nature and justification of knowledge claims and that personal epistemological beliefs evolve with time.

To my fascination, I found a lot of similarity between the literature on personal epistemology and critical thinking. As with CT, personal epistemology has ancient and deep roots in the discipline of philosophy. Epistemology has, in recent years, captured the imagination of those psychologists and psychometricians who are currently and furiously working to measure aspects of epistemology. The field of research in epistemology is burgeoning and the current debates in the epistemology literature resemble the theoretical debates in CT during the early eighties. Theorists and researchers are publishing papers to establish the scope and definition of epistemology and its components, and are engaged in polemics and debates to mark conceptual boundaries and philosophical distinctions between related constructs. Interestingly, similar to the CT literature, there are debates on the domain specificity or generality of personal epistemology.

A substantial amount of work in personal epistemology has focused on the stages of epistemological development (Perry, 1970). The stages outlined by Perry (1970) have a distinct developmental hierarchy. While an exploration of these stages is integral to understanding the development of individuals as critical thinkers, I will delineate from such an analysis in this study for the following reasons. First, this study does not seek to understand the development of faculty as critical thinkers. Second, the hierarchical nature of the developmental stages outlined in the epistemology literature when applied to the views held by faculty could lead to making judgments on the views held by faculty. This would hamper developing an exploratory understanding on how personal epistemology influences faculty perspectives on CT and will lead to a more judgmental approach.
Closely associated with the nature of knowing is the process that individuals use to justify knowledge and how individuals construct notions such as truth and belief systems. As some in the critical thinking literature have held, critical thinking is a process that helps arrive at truth, conclusions, resolutions, and summaries of the contextual data or evidence that was examined. Bailin (2002) argued that becoming a critical thinker involved complex questions on what should count as knowledge. Given the disciplinary nature of this dissertation, each piece of data that I collected came laden with elements of how faculty made judgments on the outcomes of CT. A related area of interest for this study is captured by Kuhn and Weinstock (2002) who held that personal epistemology involves the “coordination of the subjective and objective dimensions of knowing” (p. 123). The tension that exists between these two elements of thought emerged strongly in my data; thereby building a strong case to examine CT and personal epistemology in combined light.

Of further interest is a concept in the epistemology literature called “ontological commitment.” When individuals learn a new concept, Slotta and Chi (2006) argued that they make an “ontological commitment that guides their understanding of fundamental aspects of that concept and leads to attributions of features or properties” (p.262). I found in my data analysis that faculty hold ontological assumptions on the nature of CT. These ontological commitments can be accurate or incorrect depending on an appropriate or inappropriate classification of the concept in question. Slotta and Chi (2006) claimed that an examination of an individual’s ontological commitments about a concept can help identify sources of understanding or misconception.

There is no empirical research to make the case that epistemology is a component of CT (Nieto & Saiz, 2011). However, there is strong anecdotal and theoretical evidence to establish a
rationale for its exploration. At the same time, there is a dearth of empirical research on how epistemology influences the CT process (Bailin, 2002; Battersby, 1989; Kuhn & Weinstock, 2002). Battersby (1989) argued that even though seeing CT as applied epistemology was speculative, it helped establish a relationship between the two concepts, thereby establishing the need for empirical research on the connection between epistemology and CT.

**Critical Thinking in Higher Education**

At the risk of muddying the waters further, I must start out by adding that CT in higher education takes on the avatar of an applied construct rather than a theoretical construct. By virtue of being situated in disciplinary contexts, individual pedagogies, curricula and university cultures, CT, when applied, acquires new complexities. In addition, there are multiple human players like students, faculty, parents, college and university administrators, accrediting bodies, employers, national governing bodies, and state and national legislators who have an interest in making CT an outcome of higher education. It is my position that within the context of higher education there is need to discuss CT as applied, rather than as a theoretical or conceptual construct. Therefore any attempt to study the state of CT or how it operates in higher education requires a pragmatic, multifaceted and contextual approach.

While there is much disagreement on the definition, nature and scope of CT, as Moore (2011) rightly pointed out, the only area in which there is agreement about CT is that the teaching CT is “an intrinsic good” (p. 261) and an integral goal of higher education. The AAC&U (2009) held that almost seventy five percent of institutions of higher education in the United States have identified CT as a learning outcome. Austin (1993) stated that “of all the skills that are considered basic to the purpose of a liberal education, critical thinking is probably at the top of the list” (p. 47). Yet, as pointed out in the introduction, it is a challenge to find
empirical studies in published research that show that students have developed as good critical thinkers as a result of the undergraduate experience.

**Current national efforts for accountability in higher education.**

As the No Child Left Behind Act (NCLB) brought government controlled accountability in K–12 education, the Spellings Report (2006) brought the spot light of accountability to higher education. Here is how the report sought to make institutions of higher education accountable for its contribution to student learning:

We believe that improved accountability is vital to ensuring the success of all the other reforms we propose. Colleges and universities must become more transparent about...student outcomes, and must willingly share this information with students and families. Student achievement, which is inextricably connected with institutional success must be measured by institutions on a “value-added” basis that takes into account students’ academic baselines when assessing their results. This information should be made available to students, and reported publicly in aggregate form to provide consumers and policy makers an accessible understandable way to measure the relative effectiveness of different colleges and universities. (p. 4)

The Voluntary System of Accountability (VSA) which emerged as the Academy’s response to the Spellings Report is the outcome of the work of the National Association of State Universities and Land-Grant Colleges (NASULGC) and American Association of State Colleges and Universities (AASCU). The VSA called for universities to voluntarily disclose value-added student outcomes like CT among other student learning outcomes to circumvent direct government intervention in higher education. The VSA decided that universities would use a common reporting method which included both testing and institution-specific measures
The common reporting template is called College Portrait and is to be published on the university’s website.

Critical thinking featured prominently on the list of outcomes for which institutions of higher education should be held accountable. To put into perspective the scope and seriousness of this endeavor, currently 329 public institutions of higher education have responded to the VSA’s call for accountability. Together, these institutions enroll 7.5 million students and award 70 percent of bachelor's degrees in the United States each year (VSA, 2008). Further details of this endeavor are available from the VSA website (www.voluntarysystem.org).

Many have argued that the Report’s call for institutional accountability coupled with the comparability clause has meant that standardization is a natural outcome even though it was not explicitly required by the Report (Ennis, 2007; Maki, 2008). Maki (2008) called the rush to standardization a “national habit” (p. 13) in the United States. This prediction came true when the VSA undertook an examination of instruments that were already available to measure CT. Not surprisingly, after its study, the VSA recommended three standardized tests - the Collegiate Learning Assessment (CLA) developed by The Council for Aid to Education (CAE), the Proficiency Profile from Educational Testing Services (ETS) and Collegiate Assessment of Academic Proficiency (CAAP) from ACT. VSA institutions could choose any one instrument to measure student outcomes on a value added model.

Of concern to this study is the fact that each of these standardized instruments used different conceptualizations of CT (Stassen, Herrington, & Henderson, 2011). As Stassen et al. pointed out, the tests used different communicative means and contexts to assess for CT. While the CLA conceptualized CT through writing and within business contexts, the Proficiency Profile test used the ability to read as the means to assess CT within academic contexts. All of
the tests assessed for discipline-general CT (Sternberg, Penn, & Hawkins, 2011, in press). In addition, the tests were found to use different test formats and report student outcomes differently. Hence it is appropriate to place the instruments and methods proposed by the VSA to assess CT under scrutiny and to examine them within the context of how CT operates within institutions of higher education.

CT and the general education program.

The general education program is at the heart of the liberal arts undergraduate curriculum (Allen, 2006). Historically, most universities and colleges in the United States were instituted to teach students the liberal arts (Bok, 2007). As the need for specialization grew, the liberal arts agenda of institutions of higher education was captured in the general education program and the need for specialization was represented in the major with which a student graduated. The overall structure of the general education program was designed to contribute toward a broad, balanced and liberal education (Allen, 2006). For this reason, undergraduate students are required to be involved with the general education program irrespective of major (Allen, 2006). The aspirations for the breadth of knowledge as the core mission of general education are capture in the multi-disciplinary structure of general education. At the center of achieving the mission of a liberal education through general education is critical thinking.

Consequently, it is difficult to find a general education program that does not include critical thinking as a core outcome (Zamon, 2008). CT in general education is focused on and assessed across the multiple disciplinary courses that constitute the general education curriculum in a university or college. The implementation of CT into general education by institutions of higher education is monitored by the five regional accrediting agencies in the United States.
Therefore, all institutions of higher education have developed some system to incorporate CT into their general education curriculum and assessment models.

**CT, curricular and assessment approaches used in general education.**

The general education model assumes that CT is a discipline-general skill and has adopted what Ennis (1989) called the “immersion approach” (p. 4) in which students are immersed into the subject matter in a thoughtful manner but CT is taught implicitly. The very structure and implementation of the general education program within the university system, as we know it, has brought practical and logistical issues into play. The general education program draws faculty and students from multiple departments, and colleges in a university. This blurs the lines for accountability and brings about a lack of cohesion that can otherwise be incorporated into regular disciplinary programs. In addition, there are a few problematic assumptions that directly relate to how CT is structured into the general education curriculum and assessment models.

One such assumption is that theorists have hypothesized that the skills of CT are positively correlated with its dispositions and that specific skills are related to specific dispositions (Facione et al., 2000). This was largely believed because there was no established means to assess CT dispositions. However, these hypotheses have informed practice in higher education where it is assumed that a curriculum that focuses exclusively on skill and rationality would also translate into the willingness and the ability to think (Facione et al., 2000). Conspicuously missing in this skilled, rationalistic model is the dispositional aspect of CT which the research has established as being vital to an individual’s development as a critical thinker (Facione, 1990; Perkins et al., 1993).
Studies have shown that CT does not improve by statistically significant margins when it is merged into the general education requirement (Paul, 2005; van Gelder, 2000). In their study of undergraduate students, Erwin and Sebrell (2003) found that the number of general education courses did not affect student performance on tasks. Perkins et al., (1993); Tishman and Andrade (1996); Winch, (2004) argued that an exclusive focus on rationality does not guarantee that an individual will always think critically on all matters. In his analysis of undergraduate students and pedagogical practices, Bain (2004) pointed to studies in the natural sciences where students could perform well on questions on a test with no change in their understanding or the way they subsequently think, act, or feel. These studies raise questions on the efficacy of approaching CT as a rationalistic skill.

Another assumption that has informed practices in general education and which has direct relevance to this study is that CT is a discipline-general skill. The pervasiveness of this assumption is evidenced more in the assessment of CT as an outcome of higher education. Consider the facts that all the three tools recommended by the VSA, the CLA, the Proficiency Profile (MAPP) and CAPP measure discipline-general CT. The rubrics generated by the disciplinary experts at the AAC&U are designed to assess for discipline-general CT. The most widely used instruments in research studies to assess CT in undergraduate students like the Watson and Glaser Test, The Cornell Critical Thinking Test and the California Critical Thinking Skills Test (CCTST) also measures discipline-general CT (Rane-Szostak & Robertson, 1996). The AAC&U’s Valid Assessment of Learning in Undergraduate Education (VALUE) rubric for CT which has come to be adapted and used widely in general education programs across the country is based on a discipline-general understandings of CT (AAC&U, n. d).
When articulating the dangers in adopting tests without knowledge of the conceptualization of CT that underlies the test, Hatcher (2001) wrote that one might be lulled into thinking a favored approach to teaching CT is yielding good results when in fact using another test may prove otherwise. I argue that these assumptions have largely been untested and are vestiges of the conceptual and theoretical debates and understandings of the term CT. As a result, several studies conducted using these untested assumptions of CT present damning results on the state of CT in students and the role that faculty and institutions play in the development of students as critical thinkers. It is time to revisit these assumptions in light of current research.

**General or discipline specific CT.**

Scholarship is deeply divided on the question of whether CT is discipline-specific or discipline-general. Theoretically, there are two views; the first holds that CT is discipline-general (Davies, 2006; Elder & Paul, 2004; Ennis, 1985; Glaser, 1985; Swartz, 1987) and the second, that CT is discipline specific (Colucciello, 1997; Donald, 2002; McPeck, 1981; McPeck, 1990; Moore, 2004, 2011; Tucker, 1996).

The generalists, whom Moore (2004) also referred to as universalists, argued that CT is comprised of a battery of skills that can be applied to all content and disciplines (Davies, 2006, p.1). Davies (2006) argued that the discipline-general skills of CT can help assess CT irrespective of the contexts and discourses used in multiple disciplines. Others like Lipman (1988) contended that CT is an enabling discipline like reading or writing and hence can be taught independent of discipline. Lipman, Sharp, and Oscanyan (1980) argued that such an approach will help students see CT as a broader skill and not confined to specific subject matter. The implication of adopting a generalist stance is that if CT is taught as discipline-general, then it is also transferable across multiple domains and disciplines.
The assessment model that grew from this tradition focuses heavily on the measurable aspects of CT like formal logic, analysis, inference and deduction that lead to a desired conclusion. As discussed earlier, the views of this school are so pervasive in the assessment of CT in general education that the most widely used commercial, standardized instruments, in general education rubrics and in all of the VSA recommended tests are discipline-general. This school has had a significant influence on how CT is applied and assessed on university campuses.

As discipline specific, CT is understood as a loose construct that is capable of taking in multiple modes of thought (Moore, 2004). Proponents of the discipline specific approach (Atkinson, 1997; Clinchy, 1994; McPeck, 1992; Moore, 2004) argued that CT takes place in context and therefore cannot be applied out of context. McPeck (1981) held that CT is subject specific and therefore, CT skills and dispositions are not transferable across subject areas. Colucciello (1997) advocated for the establishment of discipline specific criteria to assess critical thinking. Donald (2002) made a case that CT cannot be taught or assessed outside a discipline or uniformly across disciplines. These scholars, in general, favor what Ennis (1989) called the “infusion approach” (p. 4), in which CT is infused explicitly into discipline specific instruction.

I will examine the implications of assessing CT as discipline-general. First, the approach operates under the assumption that a standard set of CT skills can be mastered and applied to all situations irrespective of context. Second, the approach draws exclusively from the standard set of skills associated with the dominant rationalistic, skilled based conceptualization of CT which is also one of the narrowest. Third, it attempts to assess CT based on a uniform conceptualization in all undergraduate students irrespective of discipline. Hence, a student who is a cello major in a conservatory of music and a student of engineering or sociology can be assessed for CT on the
same standardized test. Fourth, more alarmingly, it also means that institutions will be held accountable only for the development of a narrow interpretation of CT in all baccalaureate students, defeating the true essence of CT.

**Critical thinking in the disciplines.**

For a moment we will set aside the philosophical and conceptual arguments, and look at research on how CT actually operates in specific disciplines. Disciplines, by nature, differ in the modes of inquiry and methods they use to understand the world. Marking some distinctions between the humanities and natural sciences, George and Straton (1999) wrote that in the sciences, scientific facts are established by developing hypothesis, conducting experiments, and formulating theory. Franke (2009) held that while the sciences use theories or models, the humanities use creativity and interpretation as tools to establish knowledge. Therefore the methods used in the sciences and humanities both require critical thinking but of a different nature (Franke, 2009).

Writing about the nature of content used in specific disciplines, Amabile (1996), a social psychologist, contrasted what she called heuristic tasks from algorithmic tasks. She defined heuristic tasks as being open ended and with no easy resolution. There are disciplines that deal more with algorithmic tasks than heuristic tasks and vice versa. Jones and Brown (1991) found that CT was conceptualized in the sciences as a rational-linear-problem-solving skill that matched the methods used in those disciplines. Lampert (2007), in her study of undergraduate students, found that problem solving in the rationalistic tradition leads to a desired conclusion while problem solving in the heuristic tradition is open-ended, ill structured and can at times lead to ambiguity. Geahigan (1997) argued that algorithmic ways of thinking are problematic when
thinking critically about heuristic forms of expression because it can be understood and interpreted in many ways. These studies show disciplinary differences in approaching CT.

Given the above research, it is reasonable to assume that the term “critical” in critical thinking is interpreted differently in different disciplines. Papastephanou and Charoula (2007) argued that the rationalistic approach to CT assumed that there are universal methodological and criteriological considerations that can lead one to objective truth. CT in the humanities, in Berube’s (2009) assessment, involved the suppleness of mind and the willingness to think in ways that do not lead to easy resolution. Therefore, the coming together of different conceptual approaches is integral to developing a holistic concept of CT. Individually they do not offer a rich and robust understanding of CT (Paul, 2005). On account of the limited scope of a specific conceptualization of CT to capture the essence of CT, Moore (2004) cautioned against a “wholesale instituting” of the discipline-general approach across all disciplines in institutions of higher education.

**Discourses on CT and faculty.**

Faculty in higher education play a key role in making a conceptualization of CT operational within the classroom (Tsui, 2001). Logically, any assessment of CT should reflect the goals of faculty who make the concept of CT operable in the classroom. Unfortunately, not much is known about how faculty conceptualize CT or how they assess it in the classroom. Nor is there evidence that faculty approaches are aligned with the prevailing discipline-general curricular and assessment approach.

Hence it is important to examine research on faculty conceptualizations and perceptions about CT and their approaches to teach and assess CT. I found that most of the studies that exist on the disciplinary nature of CT focused on establishing philosophically defensible arguments
rather than the analysis of actual evidence. The few empirical studies on faculty and CT are evaluative in nature. Take for instance the California Commission on Teacher Credentialing, which conducted a large scale study across teacher education faculty in 38 public and 28 private colleges and universities in the state of California (Paul, Elder, & Bartell, 1997). They found that 89 percent of faculty claimed to be teaching for CT but only 19 percent of them could define CT and only 9 percent were teaching to develop CT in the classroom. Pithers and Soden (2000); Paul (2005); and Halx and Reybold (2005) found overwhelming evidence in published and their own research that revealed that faculty rarely know how to define CT or how to effectively teach it in the classroom.

Interestingly, Halx and Reybold (2005) reported that most faculty were good critical thinkers themselves, supported critical thinking as part of their teaching mandate and supported its pedagogical application. I argue that if faculty were good critical thinkers themselves but were unable to define the term from a researcher’s perspective, the problem may lie in the fact that there are multiple interpretations of CT and the result of a study could very well depend on who asks the questions. Evidently, these evaluative studies have used a specific conceptualization of CT to measure faculty. Such an approach is heavily dependent on using a specific conceptualization of CT as the benchmark. Hence these studies end up being an indictment of faculty, while ignoring the realities and influences on faculty conceptualizations of CT.

Another problem with the empirical studies like the one conducted by Halx and Reybold (2005) is that they treated faculty as a monolithic bloc without disciplinary analysis. Moore (2011) in an interesting study examined the disciplinary approaches used in different courses concluded that faculty approached CT as discipline specific. However, his sample was drawn
only from disciplines in the humanities and focused on assessment related issues. Halx and Reybold (2005) concluded their study calling for more research into faculty perceptions of CT.

I found that there was no research that compared conceptualizations across liberal arts disciplines like the natural sciences, social sciences or humanities. Most of the contextualized studies on CT and faculty were conducted in the field of nursing. There exists rich qualitative research in this field that can provide models for research in the liberal arts. While examining the instructional methods that faculty used to teach CT, Zygmont and Schaefer (2006) argued that if CT is assumed to be unrelated to a specific disciplinary domain, it is important to understand how faculty taught for CT. Strengthening my position on this issue, they found that around 80 percent of programs in nursing taught CT specifically within the discipline but used discipline-general tests to measure CT. There is strong reason to believe that programs in liberal arts discipline too could be using discipline-general approaches to assess for CT.

In a timely study, Stassen, Herrington, and Henderson (2011) compared their institutional definition of CT with those that underlie the three VSA recommended standardized tests and the VALUE rubric. They found little in common between their university’s definition of CT and the definitions used in the three VSA recommended standardized tests. In their analysis they found that the VALUE rubric most closely aligned with their campus definition. However they listed as a limitation of their study, that their campus definition did not “reflect faculty beliefs about the relative importance of each of these constructs” (p. 134), thereby strengthening my claim that faculty were and are being ignored in the VSA’s approach to assessing learning outcomes and have been ignored in the research literature.
Problematic Areas in the Scholarly Discourses on CT

In order to develop the rationale for this study, I will highlight what is problematic about the prevalent discourses on CT and its application to higher education. A key question that emerged from the review of scholarly discourses on the definition of CT is whether the term can be defined and whether any definition can claim properties of universality. As revealed in the wide array of opinion on definitions of CT and the complex and value-laden elements of the construct, such a goal is utopian. The difficulty in defining CT is that individual definitions emerged from personal theories, epistemologies, interests, and agendas (Johnson, 1992). Within higher education, the focus shifted to making a conceptualization of CT operable in a classroom through pedagogy, curriculum and assessment. Most of the studies on CT assessment were criticized as being philosophical rather than practical (Williams & Worth, 2001). There is a need for research that examines CT in context.

When one considers the implementation of CT in higher education, what emerges are disconnects at several levels. Two fundamental assumptions that underlie the discipline-general approach to assessment of CT in general education has not been adequately vetted and questioned. The first assumption is that CT is discipline-general. The second, which logically flows from the first, is that the discipline-general approach largely focuses on a rationalistic conceptualization of CT but it is used as a valid measure of CT in all disciplines. The problem is that when CT is largely assessed as an outcome using instruments that subscribe to a narrow conceptualization of CT, it may not reflect how faculty from different disciplines teach for CT in the classroom or how students learn CT through disciplinary curricula and pedagogy. There is need to move from philosophically defensible arguments and polemics to an empirical examination of how CT operates in the undergraduate classroom.
Taking a wide-angle look at the research literature in critical thinking revealed that current research focuses heavily on identifying, defining and measuring the skills that make a critical thinker. As a result, psychometric, quantitative methods have dominated empirical research on CT. Given how contested CT is as a concept and the several schools of thought within it, the exclusive focus on a particular conceptualization of CT as epitomized in an assessment instrument and type of research methodology has limited value and scope. This becomes evident in the inconclusive results that have followed every meta-analysis on quantitative research in CT (van Gelder, 2000). There is a need to study CT using approaches that collect a wide variety of data that is rich in context. It is my position that such data would need to be examined using inductive, interpretive, qualitative approaches.
Chapter 3

Research Genre and Procedures

“The self is the instrument that engages the situation and makes sense of it.” (Eisner, 1991, p. 34)

My goals for this study were to extract, examine, compare and contrast faculty conceptualizations of CT and assessment practices within and across disciplines in the humanities and natural sciences. In chapter one, I established the rationale and significance of this study. In chapter two, I discussed scholarly discourses on CT and its operation within higher education. I also identified why the study of faculty conceptualizations of CT and their approaches to its assessment was under researched and how important it was to conduct such an examination using qualitative means. In this chapter I will describe how this study was designed as a response to problematic areas in the scholarly discourses on CT. I will outline the research genre and procedures that were adopted and the rationale behind procedural decisions. I have also identified threats to validity and my response to such threats.

Research Questions

The following questions were addressed in this study:

1. How do faculty in the Humanities conceptualize critical thinking?
2. How do faculty in the Natural Sciences conceptualize critical thinking?
3. How do faculty in the Humanities and Natural Sciences assess for CT in students within the context of general education?
4. How do faculty make judgments on what constitutes critical thinking?
Research Genre

This study brings together three qualitative processes - data collection, coding and analysis (Miles & Huberman, 1994). Data were collected using individual interviews, focus group discussions, brief surveys and by collecting assignment prompts and assessment rubrics from participants. These qualitative means made available data that were rich in detail and situated within the personal and disciplinary context of faculty. As the goal of this study was to examine conceptualizations of CT held by faculty within their disciplinary affiliations, an interpretivist, inductive framework was found most suitable for these reasons. I used grounded theory as espoused by Strauss and Corbin, 1990 to analyze and frame the findings of this study.

I adopted this approach for several reasons. First, the literature revealed that faculty taught for CT based on their own conceptualization of it. Ontologically, interpretative research assumes that social reality is multifaceted and constructed (Lincoln & Guba, 1986). The application of an interpretive framework helped uncover the multiple meanings with which faculty use CT in the classroom. Second, the literature revealed that faculty taught for CT implicitly and within disciplinary contexts. Piantanida and Schoonmaker (2010) affirmed that the mechanisms of interpretive inquiry provide the framework to “encounter, listen, understand and thus experience a phenomenon” being studied. A qualitative framework lent itself well to this exploratory investigation and helped uncover how faculty constructed their conceptualizations of CT and provide an understanding as to how they assessed CT in the classroom.

Third, the interpretivist framework enabled me to acknowledge my positionality and role as an investigator. As Eisner (1991) pointed out, the self plays an integral role in all stages of interpretivist research. This is consistent with my ontological and epistemic stance to research and my role as an investigator. Even though the study is designed to understand disciplinary
influences on faculty perceptions of CT, I did not know, a priori, what I would find. The inductive approach helped keep the door open for new lines of inquiry which proved very useful in this study. This will become evident in subsequent chapters when I examine how personal epistemology influenced faculty conceptualizations of CT.

Ethical Commitments

While designing the study, developing interview guides, analyzing and reporting data, I worked under the principle and “expectation of goodness rather than a search for the problem” (Davis, 2003, p. 209). I committed to conduct an exploratory study with no intention of judging faculty or their views. Hence, I have not developed an operational definition of CT nor identified a standard definition of CT from the literature with which to measure faculty. My epistemic commitment was to examine how faculty conceptualized and assessed CT and to allow the data and the methodology to lead me to findings. This does not mean that I ignored issues that posed difficulty to my ethical stance. It means that I have taken a constructive stance in such cases.

Research Procedures

Research location.

This study was conducted at two large public universities. The first university was located in the Midwest and enrolled around 36,000 undergraduate students. The other was in the Southwest and enrolled around 20,000 undergraduate students. I will refer to these universities using these pseudonyms - Mid-Western University and South-Western University. The need for using two universities was primarily due to personal reasons. I found employment in the midst of the data collection process and had to move across states. However, both universities shared similarities that are relevant to this study.
The Carnegie Foundation had classified both universities as Research One. Both universities are public, land-grant universities and are part of the Voluntary System of Accountability (VSA) for reporting general education outcomes like CT using College Portrait®. The general education programs at both universities are accredited by the Higher Learning Commission and North Central Association of Schools (HLC/NCA). Both universities had recently redesigned their general education programs to realign with institutional culture and disciplinary diversity, and need for breadth of knowledge. Hence the two universities broadly shared the same philosophy and goals for general education. However their approaches to curriculum and assessment as relating to CT were unique.

The general education program at South-Western University was governed by two committees. One committee oversaw the curriculum and another was in charge of how general education outcomes like CT were assessed. With regard to general education, the university had specific courses designated as general education courses, some of which were specifically designated as teaching for CT. It was assumed that faculty taught for or focused on the development of CT in such designated courses. The assessment office at the university extracted student artifacts from courses designated as teaching CT. Over each summer, a multi-disciplinary panel of faculty was recruited and paid to rate the student artifacts for CT outside the context of the student grade for that course. For example: a student submitted a response for a class assignment for the course Biology 101. The professor would grade the assignment which contributed to the student’s grade for that course. After that, the assessment office would make a copy of the artifact, remove any identifier information and hire a different faculty to grade the artifact specifically for CT. Writing was the only type of student artifact used for the assessment of CT. Raters used a discipline-general rubric developed at the university to assess for CT in all
student artifacts. For purposes of VSA accountability, the university used the standardized test called MAPP which also assessed for discipline-general CT.

At Mid-Western University, the general education program was described as foundational to the university’s academic plan and integral to a liberal education with a goal to create life-long learners. Critical thinking was given a place of importance as an outcome of general education. A General Education Coordinating Committee which had representation from several colleges and units within the university provided leadership to the general education program. With regard to critical thinking, the university used a discipline-general rubric to assess a specific student rather than a specific artifact. As a response the VSA, Mid-Western had piloted the use of the CLA, a standardized, discipline-general test. It is currently in the process of collecting data on critical thinking for the first cohort as part of the VSAs requirement for universities to present value-added learning gains in undergraduate students.

Gaining entré.

My welcome to the world of faculty was not particularly encouraging. Here are some of the responses from faculty who declined my invitation to participate:

- “I have no part to play in this.” - Professor in Psychology
- “I don't think we tend to emphasize critical thinking as much as other departments. I will not participate.” - Professor in English Literature
- “I would say, against your wishes, that faculty are reluctant to participate because they believe they are among the busiest citizens on the earth… My option is not to participate in this interview. I wish you luck!” - Professor in Chemistry

My initial strategy for entre was to contact department heads for leads on faculty who taught general education courses in their program. The few who responded to my initial request
wanted nothing to do with it. Disappointed, I searched the websites of colleges in which the disciplines of my interest were housed. I selected faculty that met my recruitment criteria and sent out 20 more invitations. I received only one response and it was positive. I sent out another deluge of invitations to different faculty and received no positive response. In addition, I also received some very defensive and close to offensive responses to my invitation. I discussed these experiences with my committee. They advised me to push on and document my experiences.

Over the summer, I decided to take up an administrative position at a large university in another State. I wrote off the resistance I faced at the previous university as something that was part of the university’s unique culture. I prepared to start data collection again at the new university and made efforts to learn from my past experiences. I made it clear in my invitation that I was conducting this research as an individual researcher with IRB approval and that confidentiality of data would be maintained.

After scouring the university’s website, I sent out nine requests to faculty who met my criteria for individual interviews. I felt rather upbeat about my chances with a tweaked invitation and approach, and with the buoyancy that new places and experiences bring. Again, I received only one response to my invitations. I knew not to take this personally as I did not know any of these individuals. Nonetheless, it was wearisome. I re-read my IRB approved invitations (Appendix D) to see if there was anything that could be construed as offensive. I also sent the invitation to my committee for a second review to see if I had overlooked text that could be offensive or disconcerting. The committee thought the invitation was fine and nudged me to stay on track and document my experiences. I took their advice and ploughed on until I collected the data I needed. As a result, the data collection process took me exactly a year after I received IRB approval for the study.
Sampling, Participants and Data Sources

This study employed a combination of stratified sampling (Miles & Huberman, 1994; Patton 2002) and homogenous sampling (Miles & Huberman, 1994). The following disciplines were clustered into groups as represented below:

<table>
<thead>
<tr>
<th>Discipline Cluster</th>
<th>Disciplines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humanities</td>
<td>Literature, Philosophy, Fine Arts</td>
</tr>
<tr>
<td>Natural Sciences</td>
<td>Chemistry, Physics, Biology</td>
</tr>
</tbody>
</table>

The sample for the study consisted of four female and 10 male participants. The teaching experience of participants, when combined, averaged approximately 11 years. The racial composition of the sample consisted of seven Caucasians, one African American, three Asians, one Latino, and one participant from the Middle East. I have provided detailed descriptions for each faculty who participated in individual interviews in chapters four and five where I discussed disciplinary findings.

After IRB approval, data was collected using multiple qualitative means: individual interviews, focus group discussions, field notes, survey questions, and analysis of assessment artifacts like syllabi, rubrics and test/assignment prompts that faculty developed to teach for and assess for CT in their general education courses.

**Individual interviews.**

I selected interviews as the primary mode of data collection because; first, interviews helped directly capture a participant’s voice (Merriam, 1998). It allowed me, as a researcher, an opportunity to dialog with participants as we co-constructed meaning within contexts (Patton, 2002, p. 196). It provided me with an in depth look into how individual faculty conceptualize
and assess for CT and also provided reliable data for comparison during data analysis. This was important given the nature of the research questions that guided this study.

Six faculty members (one from each discipline within each discipline cluster) were interviewed individually. The following criteria was used to recruit faculty for individual interviews: (a) teaching in a public university, (b) tenured, (c) currently teaching or taught an undergraduate general education designated course that focuses on CT as a student learning outcome, (d) drawn from disciplines in the Humanities, Natural Sciences. I sent out invitations to faculty who met the above criteria and interviewed with those who responded positively.

Each interview lasted approximately an hour and was audio recorded. I also made observational notes during the interviews. Interviews were conducted using a semi-structured interview guide. The interview questions revolved around personal definitions of CT, components faculty ascribed to CT, attributes or characteristics of good and poor critical thinkers, disciplinary understandings of CT, and how faculty approached the assessment of CT in general education courses (see Appendix A). The interview guide was vetted in a pilot study with two faculty members and went through several rounds of revision before being adopted.

**Focus group discussions.**

Data were also collected using focus group methodology (Krueger & Casey, 2000). I selected focus group methodology for three reasons. First, it allowed for multiplicity of perspective (Morgan, 1996). Second, it helped amplify, substantiate or clarify patterns (Cohen & Crabtree, 2006) observed in other data sources. Third, it provided scope for cross disciplinary comparison. The following criteria was used to recruit faculty for the group discussion: (a) teaching in a public university, (b) currently teaching or taught an undergraduate general
education designated course that focuses on CT as a student learning outcome, (c) drawn from disciplines in the Humanities, Natural Sciences and Social Sciences.

The logistical difficulty in bringing together faculty schedules for a group discussion was laborious and more time consuming than I had anticipated. Hence I decided to collect data from a faculty group that was already involved with a critical thinking exercise at the university. A focus group comprising eight faculty members (different from individual interview participants) drawn from disciplines in the humanities, social and natural sciences met for approximately an hour. Litchman (2010) recommended a sample size of 6-12 for a focus group discussion.

Faculty participants in the focus group had spent an academic semester working individually to incorporate CT into their classroom practice and assessment. The context for our meeting was to discuss their experiences in developing pedagogical strategies to develop the process of CT in their students and the specific assessment approaches that they had developed. They also recounted the challenges they faced in implementing their approach and changes they would make to their approaches for the future. I made detailed observational and content related notes during the discussions.

**Brief survey.**

Participants were requested to complete a brief demographic profile and answer questions that related to their connection with how CT operated on their campus at the institutional level (Appendix C). The survey data provided insights into faculty perceptions and engagement with CT beyond their individual courses. It provided data to compare and contrast the findings from faculty pedagogical and assessment approaches to CT in the classroom with institutional approaches.
Assignment prompts, assessment rubrics and syllabi.

During the interviews and focus group discussions, I requested that participants share prompts for course assignments that they used to assess for critical thinking. I also requested rubrics or other instruments that they used or developed to assess for CT in their Gen Ed courses. These data were used to examine whether and how faculty assessed for CT and to identify influences that faculty relied on when designing assignments and instruments to assess for CT in the classroom. It provided insights into how faculty actually approached the assessment of CT and allowed for triangulation among data collected from the interviews and focus group discussions on how faculty conceptualize CT.

Data Analysis

I determined that the data analysis processes used in grounded theory (Strauss & Corbin, 1990) would help achieve my stated goals for data analysis. The data collected through individual interviews was transcribed verbatim. I then imported all the data sources – interview transcripts, field notes from the interviews and group discussion, survey data, assignment prompts and assessment rubrics into NVivo 9.0. All these data were coded were consolidated and analyzed using features in NVivo 9.0.

Consistent with grounded theory methodology (Strauss & Corbin, 1990) I utilized three processes: open coding, axial coding, and selective coding. During the open coding phase, I broke down the transcribed data sources using codes that were inductively developed from the data. My goal during the open coding phase was to, as Patton (2002) put it, break data into smaller units and delineate the larger themes and concepts. To aid operational ease and clarity, I broadly defined each code that emerged using memos (Miles & Huberman 1994) in NVivo 9.0.
Given the theoretical and complex nature of data I was processing, these memos helped me keep track on why I created specific codes.

After breaking the data apart, I used the process of axial coding (Strauss & Corbin, 1990) to assemble the data around new categories. This process helped bring together data collected from the interviews, and group discussions and observational notes and helped me classify data. As suggested by Strauss and Corbin (1990), I brought data together using “context, action/interactional strategies and consequences” (p. 96). The categories derived from axial coding formed the basis to compare and contrast conceptualizations of CT across disciplines and discipline clusters. The outcome from this process formed the basis for checking for congruence or discrepancies among multiple data sources within each discipline cluster. This helped with validation of findings and opened the possibility for alternative explanations and as Maxwell (1996) called it, “discrepant evidence” (p. 93) to emerge from the data. In addition to the dominant themes, it forced me to analyze discrepant evidence (Walcott, 2009) and examine their persuasiveness as alternative explanations.

The final stage of analysis used selective coding, which is an integral process in grounded theory (Strauss & Corbin, 1990). This process led me to identify and classify findings into three core categories – disciplinary influences on conceptualizations of CT, faculty ontologies on the term CT and the role of personal epistemology. These core categories formed the basis for the presentation of findings in chapters four and five and seven.

While the grounded theory approach led me to a global understanding of what the data was saying, the multiple layers of conceptual data combined with the stratified sampling method required analysis at multiple levels. At that stage, I listened to the recordings of the interviews and read notes from the group discussions several times and made memos of my thoughts (Miles
& Huberman 1994). This served as a reflective and self-correcting process of the patterns and broad themes that I was seeing in the data. It also helped identify inconsistencies in patterns that I had observed. I found this to be an iterative and integrative process.

For instance, I found that a purely disciplinary classification of the data failed to portray the uniqueness that each individual participant brought on how faculty assessed for CT. As I refined and integrated ideas around the categories that emerged from selective coding, the findings grew in depth and exploratory power. Hence, I have presented my analysis and findings at three levels: the individual level, a within disciplinary cluster, and a meta-analysis across disciplinary clusters.

The above data analysis procedures are consistent with sampling, data collection procedures, and the interpretive framework used in the study. The rich, descriptive qualitative data together with the inductive grounded theory approach helped me uncover fascinating insights into faculty understandings of CT.

Trustworthiness – My Response to Threats to Validity

There is much debate in the literature on whether interpretive research can seek validity; as the notion of validity has strong positivist associations. Maxwell (1996) makes the case that validity is not necessarily tied to establishing objective truth but ensuring that the outcomes of research are trustworthy and credible. I agree with Maxwell (1996) that threats to validity are guarded against, first by evidence and that strategies should help bolster the credibility of evidence. As the framework that informs this research is interpretivist, I worked to establish the trustworthiness of (a) the researcher, (b) the nature of data that were collected and how data were collected, and (c) how data were analyzed and interpreted.
**Trustworthiness as a researcher.**

As a qualitative researcher, I am aware that it is impossible to detach myself from the study and that my epistemic stance will influence my approach and the outcomes to the study. Glaser and Strauss (1967) argued that a researcher should possess “theoretical sensitivity” (p. 46) to offset the effects of personal bias when conducting grounded research. To them, *theoretical sensitivity* involved recognizing that a researcher is part of the study, examining what the researcher brings to the study, possessing the ability to bring theoretical insight into the area of research and making sense of those theoretical insights within the context of the study.

In keeping with the interpretive framework that informs this study, I have laid out my personal interest in the study, positionality and epistemic stance at the outset. In addition, I have situated the study within multiple bodies of research literature and have used research procedures that are consistent with the theoretical framework and questions that guide the study. This approach is intended to establish reflexivity and underscore the fact that, as an investigator, I am part of the study and will influence its outcomes. However, in order to minimize the effect of my personal biases, I have utilized a number of data collection and analysis strategies recommended by Maxwell (1996), Miles and Huberman (1994) and Johnson (1997) for interpretive research.

**Trustworthiness of data and data collection procedures.**

In terms of sampling and participant selection, I wanted to be sure that that I did not interview faculty who would tell me what I want to hear. As an investigator, I was not in a position to know the epistemic stance of specific faculty before I interviewed them, as I do not belong to nor have studied at the colleges where data were collected. The study also used a combination of sampling techniques that enabled the data to speak directly to the research questions at multiple levels. Miles and Huberman (1994) held that the design of the study is
strengthened when multiple sampling strategies are used. The criteria based approach to sampling ensured that I was not biased in participant selection.

Maxwell (1996) held that the validity of description posed a serious threat to qualitative research. To him, validity of description involved capturing accurately and completely what one saw or heard. I used several strategies to maintain the validity of description. First, the data collection methods used in the study - interviews and focus group discussions - helped directly capture a participant’s voice (Merriam, 1998). I voice recorded all the interviews, made detailed observational notes and transcribed data verbatim. These approaches ensured that the participant’s perspective was captured accurately and served as the basis for data analysis.

To factor in for the effect of my physical presence as an investigator or for reactivity as a threat to trustworthiness, I tested and refined the interview guide and my interviewing skills with trial participants. I also wanted to collect data that was consistent with how faculty conceptualized and assessed for CT. To that end, I framed into the interview guide, multiple questions around similar themes that served as cross checks for consistency in a participant’s thought patterns.

**Trustworthiness of data analysis and interpretation.**

Given my stated positionality on this study, I needed safeguards to keep from reading or interpreting what I wanted to from the data. Hammersley and Atkinson (1983) defined this threat to validity as inherent reflexivity. I viewed inherent reflexivity as a serious threat to validity and so I incorporated several safeguards.

First, the need for the study emerged from within the context of gaps in the discourses and empirical studies on CT in higher education. Second, in order to strengthen the credibility of the findings, the study gathered data from multiple sources - individual interviews, focus groups,
observational notes, assignment prompts and assessment instruments. Johnson (1997) advocated the use of this strategy to aid in triangulation during data analysis.

I am cognizant that triangulation itself is not a mantra for validity. Hence, the use of multiple data sources (Johnson, 1997), multiple sampling techniques (Miles & Huberman, 1994), the nature of the data sources (Maxwell, 1996) interlaced with the use of grounded theory (Strauss & Corbin, 1990) for data analysis, are all intended to let the data and methodology lead me to and lend credibility to findings. The processes of open coding, axial coding, and selective coding used in grounded theory helped with identifying and mining the data for multiple and divergent themes.

In addition to dominant themes, as Walcott (2009) recommended, I also identified, analyzed and incorporated discrepant cases into my analysis. Given the grounded theory methodology adopted in this study, this approach forced me to analyze and examine persuasiveness of discrepant data as possible explanations. This approach led me to apply new literatures and frameworks on personal epistemology to explain the data. It turned out to be, in my estimate, a very valuable tool to data analysis.

To ensure that I accurately and adequately represented a participant’s perspective; I incorporated a few checks. To preserve the voice of the participant, I have used direct quotes from the interviews and group discussions. To rule out misinterpreting the participants, I attempted to use member checking (Lincoln & Guba, 1986). During interviews, participants were requested to indicate their preference to review my interpretations of their interviews. I did not receive feedback when I sent out my findings to faculty who indicated favorably to member checking. This being a dissertation study, I also had the luxury of feedback from my dissertation chair and the panel of experts on my dissertation committee.
**Limitations**

This study examined broad questions that pertained to multiple disciplines, and used what can be considered a small sample with interpretivist approaches. As Quantz (2007) pointed out, interpretive studies do not make a claim to generalizability. Instead, the focus is on trends observed in the data, an examination of how faculty made meaning of CT within contexts, and the transferability of findings. Therefore, the goal of this qualitative endeavor was, as Firestone (1993) put it, analytic rather than a sample to population representation. These analytic insights can be used to understand the perspectives on CT that exist among faculty across various disciplines.

Conspicuously missing from this analysis is classroom observations and the collection and examination of faculty evaluation of actual student assignments. Some may view these to be a draw back in the design of the study. Since the focus of this study was on how faculty conceptualized CT, I hold that the multiple data collected for the study provided sufficient scope to legitimately speak to the research question.

Given the difficulty I had in getting faculty to respond positively to my invitation, I recruited only faculty that were willing to participate. It is difficult to state why faculty chose to participate or why others rejected the invitation and how this impacted the findings of this study. That said, it must be pointed out that all participants met the recruitment criteria for participation that was set before recruiting participants. In addition, since the goal of this study was exploratory rather than evaluative, as long as faculty met the recruitment criteria, all of them were eligible for participation irrespective of their understanding of CT or their disposition to my invitation. Hence I argue that it did not pose a serious threat to the validity of the findings of this study but sufficiently raised questions that are difficult to answer.
In this chapter, I discuss my analysis and findings on conceptualizations of CT held by faculty in natural science disciplines. In order to achieve disciplinary comparison and contrast, I have taken an individual and thematic approach to presenting data. For purposes of ease of reading and quick association, I have used pseudonyms to identify each participant that begin with the alphabet of their discipline. For example, Brenda is a professor in Botany; Charles, a professor in Chemistry and Philip, a professor in Physics. This association will help readers easily identify disciplinary leanings and give participant statements personal identification each time I reference specific ideas in this chapter.

**Participant Profiles**

**Brenda – professor in botany.**

Brenda was a botanist by profession. She identified as a Caucasian, female and had over 20 years of experience teaching in her field. She researched evolutionary patterns in plants. Specifically, she used molecular markers to understand bio-geographical patterns and the diversification of plant species. I walked into her office and she was very excited to see me and was one of the few faculty who willingly agreed to talk with me. She had a very pleasant disposition and I felt like we connected well at a personal level. Her office is spacious and pleasantly decorated with beautiful, colorful pictures of plant life. She sat away from her desk and gave me her undivided attention during the interview.
Charles – professor in chemistry.

Charles was a chemist whose research involved applied, inorganic chemistry. He identified as a Caucasian, male and had 19 years of experience teaching chemistry. I was a few minutes late for the interview and he made his displeasure clear. I could not help notice that his office was littered with papers and research articles and a layer of dust covered the room. A heater warmed the room and I was grateful for the air it was blowing into the room. Once the interview began, he was very cordial and engaging. He gave me a great interview and was willing to talk way beyond the slated interview time.

Philip – professor in physics.

Philip was a physicist who researched in the area of computational modeling. He identified as a Caucasian male and had over 30 years of teaching experience. He described his research agenda as a combination of developing algorithms and computer codes for calculating various properties using a range of different equations that described electronic structures within quantum mechanics. He used a combination of quantum mechanics and classical mechanics that is used to describe how things move around at the molecular level. It involved differential equations of one kind or another. Needless to say, I did not understand a word of his research description. He had a very pleasing, warm personality but he was difficult to interview from a qualitative perspective. He turned questions back to me and wanted to know what I thought before he ventured on an answer. Even though the interview felt like a game of cat and mouse, he revealed a depth of understanding of critical thinking. It however took me a while to convince him that my study was exploratory rather than evaluative and hence it was important for me to know what he really thought.
“I’m having a hard time with these questions!”

“These aren't the questions I thought you would ask and they're hard for me because if that's really your study; this is a term that I don't use typically and try to avoid” – Philip

“I think these are kind of vague questions, so it's a little bit hard” – Brenda

“I think it's like asking what makes being sentient and non-sentient” - Charles

My experience interviewing faculty from the natural sciences was interesting. Moments into the interviews I felt like I was speaking a foreign tongue. Brenda often exclaimed and sighed as I asked my initial questions. She constantly asked me to repeat or rephrase my questions and told me my questions were vague. Philip was forthright and told me if the rest of the interview contained questions like these, he was not the right candidate for the interview.

To a degree, I thought that my accent was getting in the way; but then, I hardly have one left. I rephrased and restated questions and they responded. As we ploughed through the interviews, I realized I was indeed speaking a foreign tongue. I had moved from my home terrain in the social sciences to the natural sciences. I was interviewing faculty in the life and physical sciences buildings. I had not switched gears. The repertoire of my vocabulary and language usages; that make a whole lot of sense to me, did not make sense to them. On a deeper level, there was something intriguing about the level of discomfort and frustration that these faculty expressed. Hence, it was something I sought to examine closely in my data analysis.

**Personal Definitions of CT**

After brief introductions and engaging participants in a discussion on their research agenda, I started out each interview asking faculty to describe in their own words, what the term critical thinking meant to them as individuals. I also asked for real life, out of classroom examples of their conceptualizations. Brenda defined CT as the “ability to take existing
information and build on it to reach a logical conclusion.” To her CT was an evaluative process that helped “differentiate fact from words people throw out.” In its broadest sense, she defined CT as the ability to use rationality to solve problems or circumstances that come up. I asked her to give me a real life example of her definition of CT. She used the example of being able to read what's going on in newspapers or on the internet today to determine if that's really a valid claim that's being made. She also recalled a time when her daughter’s dishwasher broke down. Her daughter had to figure out whether to call the electrician or plumber. Solving that problem, and being able to think the options through, to her, involved CT.

Charles defined CT as “being able to look at the facts or look at what’s written and decide what is important and what may true and what might be wrong and then develop one’s own ideas based on analytic data and facts.” He chose to use the example of the debate on global warming to highlight critical thinking. His words best capture the essence of CT in that example, “You know, you can find really right-wing, left-wing arguments about it, and it's like politicians almost. And if you're somewhere in between, have some doubts about one way or another, they want to just label you. If you really want to understand global climate change, you have to be able to, glean through what's true out there and there's so much horse hockey on both sides.” His example highlights the inconclusive nature of evidence that surrounds the subject of global warming, and the contested nature of opinion on the subject.

Philip, on the other hand, refused to define CT independent of context. However, he readily identified CT as being relevant only in the humanities. I pushed him to define the term and he retorted, “Critical thinking is some sort of logical analysis of the pertinent ideas in some piece of writing would be probably be the first assessment, the first interpretation if someone said critical thinking.” I asked for an out of classroom example that personified his
understanding of the term. He laughed as he said “an example for a term I do not use?” Since he
identified CT with the humanities, I asked for an example in that context. He said that critical
thinking when reading a novel would be “first an examination of the plot, the characters, and
then trying to delve deeper into what are the possible, if this were a real situation or based on
human nature, what would, if the characters are human presumably, what would the human, what
would the normal motivations be for the behaviors shown in... to me that would be it.” It is a
buzz word, he asserted, that needed context to be relevant.

An analysis of the personal definitions of CT revealed that all these participants saw it as
an evaluative, logical process that is applicable in situations where information abounds but facts
cannot be easily established. CT involved making interpretations, evaluating conflicting claims
and counter claims and being able to reach a logical conclusion. At this stage, it is important to
note this aspect in their understanding of CT as I will pick up this strain of thought for further
analysis later in the chapter.

Thematic Finding 1: Faculty Viewed CT as Tied to Disciplinary Thinking, Content and
Methods

Brenda – critical thinking is problem solving and decision making.

Brenda defined CT as the ability to critically evaluate data, the ability to identify patterns
and reason through such patterns to make logical decisions. To her, CT was not only a cognitive
skill; it had to also be applied to decision making to be meaningful. She said CT was required,
“not only to just interpret data or graphs that are thrown at you in the literature, but to also be
able to test problems. You need to know how to set up some type of experiment. You need to
figure out what types of tests and statistics need to be done. Well, what did that even tell you
about your question? You know, what kind of data to pursue that would actually answer that
question?”

Therefore, to her, in the biological sciences, CT was an integral element in solving complex problems through good decision making and quantitative means. Her association of CT with disciplinary content and ways of thinking became clear when she associated various aspects of CT within multiple disciplinary settings and with varying degrees of complexity. In the classroom, she held, reasoning skills were required to examine data and the validity of research data in journal articles. In the laboratory, CT was the ability to reason through multiple hypotheses and the ability to make decisions on which lines of reasoning to pursue. Within the context of research in botany, CT was the ability to ask the right questions, quantitatively test a hypothesis and reach logical conclusions. She thought that the progression toward complexity, for undergraduate students, was developmental. She said that the progression toward disciplinary complexity started in the classroom, the lab and then to actually conducting research in the field.

Speaking on the importance of CT in her discipline, Brenda said “If you just put it on a scale, I mean it’s a science, it's up at the top. It's a very quantitative kind rather than a qualitative kind.” She identified reasoning abilities, observational skills, background disciplinary knowledge, the ability to comprehend and interpret, and decision making skills as important components of CT. She also seemed keen to point out that CT in Biology was similar to Physics and Chemistry in that it used logical, scientific, mathematical models. “It’s plant biology” she said, “and I think any of the sciences or any of the biological disciplines are going to be very data driven, observation driven, testing driven.”

Despite the heavy focus on logical reasoning processes and the heavy dependence on quantitative reasoning skills, Brenda acknowledged that biology deals with living organisms,
which makes analysis more complex than physical sciences in that it always involves multiple variables that cannot be easily controlled. She spoke of an irreducible complexity in biology when studying an organism and its relation to other living organisms versus the ability to reduce a problem to a single variable in the physical sciences. I asked her if the behavioral parts of her discipline brought relative or subjective elements to CT. While she admitted that there was an element of unpredictability, she argued, “I think biological sciences are very much based on the scientific side.” By scientific, Brenda made a case that biology used mathematical procedures to achieve validity and empiricism.

When I asked Brenda how she taught for CT she said “I would model it. I would be looking at lots of data. Looking at lots of hypotheses, examining the data and coming to some kind of conclusion or inference about what the data shows us.” She spent a lot of time telling me about how frustrated she was with some of her students’ critical thinking abilities. Her frustration is captured in our exchange:

Brenda: I think that some people, you work with them and teach them, but some people, they just, it's, you know, they just don't have that spark. They just you know, they just learn stuff and can't do things.

Mark: So they can reach that stage where they are able to reason, but not able to go beyond.

Brenda: Yeah, I think so. They can repeat what you tell them to do. They can sit down in the lab and put these things in a tube and put this here, and they might actually get really good results because they are good with their hands, but they don't really understand how they got from the beginning to the end or it's just kinda a black box in the middle. They are very, very bright and have all the skills, that needed up to that point. But then they get
stuck. They've gotten themselves to this point, but they lack the confidence to take that leap.

Mark: So you think it's confidence?

Brenda: Well, I don't know what it is, honestly. Um, that they can't just make the leap. I guess my example is you've got these specimens in front of you and you can see there are very clear differences, or these two different species. And they can give you all kinds of background information, but then they can't for the life of them, they can't do that final step. I would guess that’s a confidence issue more than a competence issue. But is it always? I don't know.”

Brenda’s uncertainty as to why these students were unable to make application of their skills is clear when analyzing her choice of words. She used phrases like “they can't, sort of make that next leap”, “can't make that next step”, “don't have that spark” and “I don’t know.” So I prod her further:

Mark: If I were to give you a student who had CT skills and you wanted to take them to this next level, what would you do as a teacher or as a faculty member?

Brenda: I think just work with them more to apply those skills. To make that decision of whatever they needed to do to make that leap. Just to build their confidence or build their self-esteem. But I don't know that this would always be effective. I don’t know.

I nudged her to think in terms of dispositions. She feels it is a lack of confidence and constantly says she does not know. So I leave it at that. When I asked Brenda how sure she was that her pedagogical approach helped develop critical thinking students, the uncertainty continued. I was surprised by the number of times she used the phrase “hopefully.” This prompted me to do a cluster analysis in NVivo® for the word hopefully. Here are some direct
quotes that I have put together to drive home the point. “it (CT) is hopefully learned and people improve…I really hope students have enough background information…hopefully their critical thinking improves over time…a lot of courses are hoping students use critical thinking to appreciate the world” She says of her methods, “in the classroom we just work problems over and over in every lecture and then hopefully they can do it themselves.”

It is evident that Brenda reported that she taught for elements of CT applicable to her disciplinary context but had not developed ways of knowing the outcome of her efforts. I switched the voice recorder off after the interview and I found myself wishing, that I did not. She turned candid and talked about how she wished she did more about critical thinking in her classroom. She rued, “I think about it when I am planning my lectures but that’s how far it goes.” She attributed it to the lack of time.

**Charles – CT is the ability to think rationally and synthesize information.**

Charles defined CT as a process that involved several things. First, it was the ability to critically look at data and papers and decipher what might be true and untrue. The second was the ability to synthesize information which involved taking two separate ideas and bringing them together to come up with a rational explanation or new idea. He was keen to point out that the ability to synthesize information is not a simple mathematical process as, a + b = c. CT in chemistry was the ability to “take what you know as facts and come up with something new.”

He gave me a classroom example of the ability to synthesize information. His students spend a lot of time studying about how molecules interact with other molecules and how that interaction affects the very physical properties of those molecules. Then he had his students take that information and attempt to predict how a mixture of two materials might interact in terms of boiling points and varying pressures. That process, he argued, enabled students to take the facts
they've learned before and see if they can reason out an answer to a little more difficult question. He likens the process to a computer, garbage in, garbage out, good critical thinkers can filter the good stuff from the garbage and come up with a new hypothesis while others are unable to do that.

With similar description as Brenda, Charles too pointed to the important role that critical thinking played when making decisions in disciplinary contexts. All of the skills that he identified as part of CT were closely intertwined with disciplinary content, methods and milieus. He held that after students had acquired disciplinary content students needed to apply what they had learned in theory. In this exchange he spoke about the role that CT played in the laboratory:

…and it's not, until that point, they have to decide, hey, I have this material, this is what I think it is. And then think, what method should I use to try to characterize that. And that's going to take some critical thinking rather than, you know, running everything or running things that are a complete waste of time… They have to look at things and think; this is what I should do. Then, the other way of critical thinking in terms of the laboratory, they want to make something by a new route…That means they have to critically think about everything they know about inorganic synthesis or organic synthesis and what it could tell us, and come up with a new approach or a new idea. I mean we try to test them like that in chemistry.

Charles identified the ability to characterize things, make decisions, acquiring disciplinary knowledge, good memory, the ability to put things in a framework and the ability to integrate facts as components of CT. Interestingly, he identified components of CT that are not traditionally part of the concept like acquiring disciplinary knowledge and good memory. He also viewed CT as developmental and as gaining in complexity as the interaction between the
number of variables increased and during the tenure of the undergraduate experience. I asked him if his discipline involved situations with ambiguity and opinion. He replied, “In Chemistry, opinion is worth nothing, if your opinion is that you mix these alkaline bases and they don’t react; then you are wrong.”

Charles also talked about a frustration with students who cannot make application of their skills. His frustration is evident in this example:

I see it all the time, people who do extremely well on testing, objective testing where, you know, the idea is to get the answer correct and they've memorized, if I see this question, this is how I do it. But they have really no understanding what the meaning of the answer is. I was giving a practice test and there was one question that tested them on a theory that actually had two different types on constants in them, called a, and b. So on the practice test, the question about this theory was about constant a, and about what it meant. And on the test, the question was about constant b. They memorized the questions as soon as they see the name of this theory and a constant, they answered as if it was the practice test rather than looking at it critically and answering the correct, even though they had the formula on the exam. And that’s, to me, the big difference.

Interestingly, this frustration was also expressed by Brenda. Some in the literature like Bailin (2002) attribute it to the heavy focus that natural science places on memorizing disciplinary content. I asked Charles how he taught for CT in his classes and he responded, “in a big class section, not very well…I mean other than showing them the reasoning and hoping [emphasis added] that they will see the reasoning too.” He too argued that the best way to teach CT was to model it. However, he advocated a positivist approach to teaching CT and singled out constructivist notions of learning as not applicable to chemistry. So I asked him how confident
he was that his approaches in the classroom helped develop critical thinking students. Charles quipped “There are people who will learn to think critically and some people just don't. Can we teach it, I don't know?” It is insightful to note that he too, resorted to words like “I don’t know” or “hopefully.” When I asked about the outcome of his efforts with CT, he said, “our job is to teach them the knowledge that they need and hopefully they can take that and use it in critical thinking out in the real world.” Charles, like Brenda, used a hopeful approach to teaching CT with no means to evaluate the efficacy of his approaches with regard to CT.

Philip – critical thinking is the ability to think logically and make reasonable assumptions.

A few minutes into the interview and Philip warned me, “We're running into trouble with your study here because critical thinking is a phrase we don't use.” Needless to say, it was a difficult interview for me to conduct and I had to move away from my interview guide to understand where Philip was coming from. So I asked him whether CT was a learning outcome in Physics and he replied, “if you are talking about critical thinking, I tend to associate it more with the humanities…In physics, I have never really worried about an operational definition…this is not a term we use in physics.” I ask why that was the case and he replied “because I think it doesn't have a firm definition in the community as far as I can tell.”

After some posturing and counter-posturing, I remained relentless with my questions. I challenged him to think about a possible role for CT as he defined it personally in a field like Physics. Consequently, he argued that CT in physics and the physical sciences in particular, would typically, have the same ideas of CT as humanities, but use a different set of phrases to describe the same thing or equivalent things. Physicists, he argued, are more comfortable and focus on words like logical structure, mathematical validity and the development of concepts. He
highlighted that mathematics was the underlying structure of physics just as any novel is written
in a language; in science, “mathematics is the equivalent of our language.” The major portion of
physics, he said, “is in understanding basic concepts and describing them in mathematical
models. It's all of physics.” The job of a good physicist was to describe how the real world
operates and to describe the underlying structure in terms of mathematics. He went on to tell me
that critical thinking required one to have a very good understanding of which conclusions to
draw on some statistics, based on the statistical validity of conclusions that can be drawn from
any data set.

When I asked him to describe the elements of critical thought that applied to the
processes he described, Philip thought that CT in physics contained both philosophical and
scientific elements. The philosophical part involved maintaining logical structures using
mathematical and statistical validity while the scientific part involved making reasonable
assumptions. He described logical structure as the “formal” part of CT that required logical
thinking and was situated somewhere between philosophy and mathematics. It was an
algorithmic logic that could be constructed in logic tables and could be used to prove the logical
validity of a question with a yes or no answer.

Then he said “the next step that you have to do to be probably a critical thinker in
physical sciences is that you make reasonable assumptions.” He described reasonableness of
assumptions as the process that facilitated the testing and validation of ideas and concepts. It was
less mathematical and more an “art of understanding.” He said it was more aligned with
engineering and was “based on experience of what you know, and part of what you do.” This
aspect of his definition of CT appeared to align with what Brenda and Philip identified as
decision making skills but his views are nuanced in that he sees it as an art.
He argued that reasonableness of assumptions was more difficult than logical reasoning and that it involved more critical thinking than maintaining logical structure and validity. This was true, he argued because it “requires you to set some criteria.” The difficulty involved answering questions like “what is good enough or how good is good enough?” I asked about how one would evaluate what is good enough. He responded that it was established through mathematical validity.

I asked Philip if there was a role for thinking dispositions in physics. He responded “What do you mean by that; dispositional? I don't use the term very much, I'm not sure...” He assured me that mine was a good question but said “I wish I knew. Uh…I’m not sure, I’m not sure, I worry about that by the time we are ready to learn such traits but then, it’s probably too late.” As a result, he too used words like hopefully when reflecting on the usefulness of his pedagogical approach. He said “I hope they pick up these portions of critical thinking and I think that is our goal, I don't know.” This exchange highlights the tension that these faculty face in balancing disciplinary content and other learning outcomes like CT in large sized general education courses.

**Summary of finding 1.**

As noted earlier, faculty in the natural sciences personally conceptualized CT as an evaluative process that is used mostly in subjective or relative situations where truth is not easily established or evident. Given the objective, mathematical and scientific empiricism they accorded to their own disciplines, the question that arose was, what role does CT play in natural sciences? When I queried these faculty on how important CT was in their discipline, they all found it to be of paramount importance. My challenge was to make meaning of how they reconciled this seeming contradiction between their subjective and objective understanding of
CT. I toyed with several ideas – did they lack an understanding of the term CT as many studies like Paul, Elder, and Bartell (1993), and Halx and Reybold (2005) have already suggested? Why did they have difficulty answering my questions? Why did I sense their palpable discomfort when using the term? Why did they brush off CT as applicable only in the humanities when the research literature showed that the dominant paradigms of CT are drawn from mathematical and natural science disciplines?

A credible explanation is that this group of faculty tended to highlight components of CT like problem solving, logical structure, decision making based on mathematical validity and scientific reasoning as important to their disciplines. These aspects have been typically associated with the rationalistic and skilled conceptualizations of CT in the literature. Within their disciplines, knowledge is created, evaluated and validated using empirical standards, immutable scientific laws, established models, statistical and mathematical validity and logical reasoning. They saw their role as disciplinary experts, as seeking to understand and explain the “real” world. Within the “real” world, as they described it, which is governed by pre-deterministic (biology being an exception with elements of unpredictability), mathematical and logical validity; CT as they defined it personally, was not relevant to their disciplines. Philip, for instance, started his interview with telling me that “if you are talking about critical thinking, I tend to associate it more with the humanities.” Pedagogically he was uncomfortable with the thought that he taught for CT. Rather, he taught elements that would facilitate success in his discipline.

A key reason that they argued for differences in approaches to CT involved the role that opinion played in the humanities. Charles held that it was quite possible to be thoughtful and critical but end up wrong in the humanities because the evaluator could not agree with your point
of view. He said of the humanities, “You know, opinions and things are really, extremely subjective.” In the natural sciences, mathematical and statistical validity created frameworks for objectivity. Further he argued, in art opinion matters but in the natural sciences, it was important to be right. Brenda argued that differences emerged because the humanities and social sciences were driven more by qualitative data. Philip, for instance, started his interview with telling me that “if you are talking about critical thinking, I tend to associate it more with the humanities.” Pedagogically he was uncomfortable with the thought that he taught for CT. Rather, he taught elements that would facilitate success in his discipline.

Therein, lay the tension. Within the context of their disciplines, CT as a mechanism for analyzing ambiguity, multiplicity of opinion, philosophical relativity or subjectivity was not relevant or applicable. Reminiscing on his discussion on CT, Philip admitted very astutely, “I think we're in some subset of critical thinking that is commonly used in higher education, and we certainly think we try to teach critical thinking, but I don't think we call it that. When we're teaching, we're teaching some subset.”

In addition, the boundaries that these faculty sought to establish for their own disciplines and the distinctions they marked from other disciplines when describing CT further revealed that they saw CT as bound up in their disciplinary processes and methods. Charles thought CT was easier in the physical sciences than in the arts as it did not have a subjective element and it was easier to arrive at the right answer. He articulated it as a “conundrum” when he said, “I was originally asserting that part of critically thinking is to come up with more of a subjective answer, rather than just objective answers to certain questions.” These faculty were more comfortable discussing components of CT that aligned with disciplinary thinking and hence were reluctant to attribute to it components that belonged to other disciplines. Hence I argue that the
deepest influence in their understanding of CT as a term was drawn from their disciplinary understandings of the term.

**Thematic Finding 2: Faculty Approached CT Implicitly Through Disciplinary Content and Methods**

While faculty from the natural sciences strongly felt that CT was very important in their disciplines, all of them admitted that they did not spend much time thinking about it explicitly. Philip argued “I don't think we would ever use critical thinking as a description, explicit description, as a way to describe the goals of the course. I think it's probably buried in there.” Interestingly, when analyzing their syllabi, I found that they did not explicitly use the term CT.

While this evidence can be interpreted that these faculty do not focus on CT, I argue that they indeed focus on elements of CT applicable to their disciplines. An analysis of the components that each faculty focused on revealed a clear association between their definition of CT and their disciplinary methods, needs and milieus. For instance, Brenda described CT as problem solving. Her application of CT to botany was to solve problems in the lab or field. Charles defined CT as the synthesis of ideas. His approach to teaching CT involved synthesizing information. In addition, their implicit approach revealed a blurred line between disciplinary thinking and CT.

I also argue that part of the discomfort that they expressed with the term can be attributed to my interview approach that sought to make the implicit, explicit. As these faculty focused on aspects CT that are implicitly tied to their disciplinary methods, my interviewing approach forced them to focus on CT explicitly as a separate entity and hence the process of making the implicit, explicit created a level of discomfort. I see this finding as having important implications because it reinforces the need for faculty development approaches to attempt to do just that!
Thematic Finding 3: Faculty Assumptions on the Ontology of CT Influenced Conceptualizations of CT and Classroom Practice

While describing their understanding of CT, faculty in the natural sciences expressed views on the nature of CT. I extracted these assumptions for a separate discussion, as I found that the ontological assumptions that they held on the nature of CT influenced how they approached CT in the classroom. While disciplinary influences are also seen in this section, the influence of their ontologies on their understanding of CT stands out.

**Critical thinking required disciplinary knowledge.**

All faculty members from the natural sciences unanimously highlighted the importance of students possessing content knowledge to be able to think critically in their discipline. In fact, they all identified having a disciplinary “knowledge base” as a key component of CT. They argued that it was impossible to be a critical thinker in their discipline without content knowledge. Charles asserted, “if you were to critically think about chemistry, you have to know something about it.” He argued that CT involved being able to think about “everything you know about the subject and what it could tell us and come up with a new approach or idea.” He furthered his argument by reversing it, “part of CT is knowing what you don’t know and getting the facts. For example, what makes water hard - calcium, magnesium?”

As a problem solving skill, Brenda argued, that students should have a broad enough background knowledge to be able to reason through a problem and reach a logical answer. She argued that students should possess a disciplinary “knowledge base” to be able to think critically in botany. She held that the knowledge is learned through interactions in the classroom and the ability to apply CT to content is more apparent in the laboratory or field experience.
Philip too held that CT involved memorization of facts. He qualified the acquisition of disciplinary content in the natural sciences as a linear learning process. He said, “the difference between say the humanities and the sciences typically, is that there’s a lot of linear learning that’s done. You have to learn a, to learn b, to learn c, to learn d as opposed to a lot of the humanities, it's a lot of different concepts that are in parallel. If you do a first, or b first, it doesn't really matter…rather than some linear flow that you have to know. You have to know differential equations in order to do Newton's mechanics, right?”

Faculty from natural science disciplines who participated in the group discussion also highlighted the importance of disciplinary content for CT. A faculty participant held that it is impossible to assess CT without students possessing good content knowledge. He rued the fact that he taught an upper level course that freshmen students could take without any pre-requisites. He talked about how difficult it was to bring students up to speed with disciplinary content. Teaching CT within that context was a luxury he could not afford.

One thing that stands out is the significant role that faculty in the natural sciences placed on disciplinary content. Hence, pedagogically too, these faculty admitted spending a lot of time teaching foundational knowledge during the first two years of undergraduate programs. As a result, teaching for CT during those years was not high on their agenda. If they did focus on CT, it was more focused on the simple logical and rational processes. Not surprisingly, some studies have indicted faculty in the natural sciences as not interested in teaching for CT during the first two years of undergraduate education (IUPUI study, 2010). There appears to be valid reasons why these faculty were not able to focus heavily on CT during the early undergraduate years. Hence this finding provides insights and room for further investigation that could help general
education curriculum committees and assessment personnel align expectations and assessment strategies with faculty approaches in the classroom.

**Critical thinking involved rationalistic skills and mathematical validity.**

An analysis of the disciplinary definitions of CT and the components of CT that faculty from these disciplines highlighted, clearly indicated that they focus heavily on the skills associated with CT. All of them broadly conceptualized CT as involving the acquisition of the skills of logic and reasoning and the application of those skills to solve problems, synthesize knowledge or make reasonable assumptions. Also evident was the heavy slant toward the contextualization of CT skills within the parameters of mathematical and statistical validity. These aspects, in addition to the heavy focus on acquiring and memorizing disciplinary content formed essential elements of their approach involving CT. Interestingly, as in the research literature, they defined CT as having both a cognitive and behavioral elements. But in its practice, they focused heavily on the cognitive elements of CT. This, in part helps explain the frustrations they expressed with students who were unable to make application of the CT skills and knowledge they had acquired.

Interestingly, these faculty also highlighted as part of CT, skills that were outside the ones typically associated with CT in the literature. For instance, Brenda identified the ability to memorize, comprehend and interpret thinking as part of CT. Charles felt a good memory and general intelligence were part of CT. Philip recognized the ability to memorize facts and the ability to communicate their thinking so that it can be evaluated. I will now analyze the role that these extraneous components play in their conceptualizations of CT within their disciplines.

I found that these faculty see CT as being integrated with other learning outcomes and with disciplinary content. While it is theoretically possible to mark distinctions between
disciplinary content and CT and between CT or the abilities to comprehend and communicate ideas; in the practice of the classroom it is difficult to teach or assess each outcome exclusively. Hence, CT, disciplinary content and the abilities to memorize, comprehend, and communicate are part of larger goals that faculty aim to achieve. It would be fair to say that these faculty view CT as a skill that is integrated with other learning outcomes and disciplinary content within the context of the classroom.

Critical thinking is a developmental process.

As a strictly cognitive process, these faculty viewed CT as a higher order skill that ranged in difficulty from simple-to-complex. As revealed in their disciplinary definitions, Brenda and Charles argued that there were different levels and abilities of critical thinking. Some processes may require more sophisticated kinds of abilities and some simple reasoning. For instance, Philip thought that making reasonable assumptions was more complex than learning and establishing logic and reasoning through mathematical means. Faculty from the natural sciences who participated in the group discussion also held similar views. They all claimed to focus on simpler thinking processes and the acquisition of disciplinary content during the initial years of undergraduate education and focused on complex problems until the time students graduate.

Their understanding of CT as developmental was also borne out in how faculty assigned a role to within different disciplinary contexts during the tenure of a baccalaureate degree. Philip talked about CT as involving levels of skills that grew in complexity and depth during undergraduate education. Charles and Brenda and Philip argued that students can learn the simple aspects of CT in the classroom but the real test of ability was when students were required to set up an experiment, determine which tests to run, test problems, determine the data to pursue and interpret its results.
Again, it becomes evident how closely tied their assumptions are to their pedagogical approaches. It also highlights the need to align curricular and assessment approaches with how faculty approach CT. I will further explore the implications of a developmental approach to CT on curricular and assessment strategies in chapter eight.

**Critical thinking is an innate skill but can also be learned with practice.**

Faculty were tentative when it came to the question of whether CT could be taught and learned. While they all held to notions that it could be learned, they also argued that it was innate but were uncertain of either claim. The literature that I have encountered (Facione, 1990; Perkins, Jay & Tishman, 1993; Tishman & Andrade, 2000) largely sees CT as a learned or acquired skill and stays clear from the notion of it being an innate skill perhaps because of the sensitive nature of such claims. Fascinatingly, these faculty were candid in expressing ideas that CT was an innate ability. Charles said “I almost think, in some cases, it's an innate skill.” Brenda thought “some people are just very good at reasoning and other are not... they are really good critical thinkers from the beginning and some are not, but they improve over time.” Philip held that some students are just good critical thinkers from the beginning and it may be in their background.

Concurrently, these faculty also held views that CT could be learned. Interestingly, here too, they expressed uncertainty in the claim. Brenda said, CT is “hopefully learned and people improve, you know, with time, so, that, I don't know.” Philip thought that CT improves with the development of quantitative skills, and with time. He attributed that to the exposure that students get on how to think about something in a certain way. As pointed out earlier, I found that these faculty were unsure on whether CT could be learned or how it was learned.
Summary of finding 3.

The ontological assumptions that these faculty held provided interesting insights into how they constructed the fundamental properties of CT. As has become evident from the above discussion, there is a strong association between the ontological assumptions that these faculty held on CT and their stated pedagogical approaches. Unique to this faculty group was the emphasis that they placed on the acquisition of disciplinary knowledge before CT could be meaningfully taught and applied. Their assumptions that CT is innate when tied to their exclusive focus on CT skills and lack of understanding of CT dispositions provide important clues about approaches used by faculty in the natural sciences to teach for CT.

What also stands out is the unanimity of opinion held by these faculty in the natural sciences on the nature of CT. Ontological elements that emerged from individual interviews were validated strongly by participants in the group discussions. Gauging the ontological assumptions that faculty hold on CT can provide useful and meaningful insights for faculty development and assessment efforts in general education programs.

Consequently, I argue that studying the ontological assumptions that faculty hold on the nature of CT can provide a good barometer of their understanding of the term. The unanimity that emerged from faculty’s ontological understanding of the term can provide general education programs with a solid basis for understanding disciplinary needs and differences while implementing curricular strategies and faculty training. The ontological assumptions can also be helpful to assessment personnel and provide rationale for nuanced and disciplinary interpretations of the results of CT as assessed by general education assessment.
Thematic Finding 4: Faculty used Personal Epistemology to make Judgments on the Outcomes of CT

While coding the data collected from faculty in the natural sciences, I found that, in addition to drawing their understandings of CT from disciplinary approaches and their ontology on the nature of CT, faculty held unique perspectives on CT that emerged from their personal epistemologies on the nature of knowledge and knowing, and truth. For simplification of this discussion, I used the term personal epistemology (see chapter two for definition) to encompass faculty assumptions on the nature of the world, the nature of knowledge, and to refer to the standards they used to make judgment on the outcomes of the critical thinking process.

At this stage, distinctions must be made between standards that faculty used to evaluate the process of justifying knowledge and their opinions on what should be the outcome of the critical thinking process, with the formal methods/approaches used to assess CT. Their personal epistemologies were evident in the process of justification and their expectations on the outcome of CT process rather than in their formal assessment methods. This was largely true in this data set because faculty admitted that they did not explicitly assess CT but did so implicitly through other disciplinary assessments. Hence I discussed the influence of their personal epistemologies on CT in this chapter. The formal assessment approaches that faculty used are discussed in chapter seven.

Assumptions on the nature of the world.

Since the framework of this dissertation is set in an educational context, the worlds that these faculty described were grounded in their disciplines. Three elements emerged when evaluating their views on the nature of the world. First, the world is real. Second, the world operates on predictable laws. Third, there is an observed level of unpredictability in the real
world. Each participant varied in the level of emphasis they attributed to the above three views on the world.

Philip argued “critical thinking in physics in particular, since we're trying to describe the real world… a major part of critical thinking is whether the mathematical models you use, really map to the physical reality you're trying to describe.” In his assessment, the world was real and the role of CT in that context was to help uncover that reality. He went on to add, “I think the underlying assumption in physics is that the universe is rational.” This adds a predictive, rational element to the real world. The direct link that Philip makes between CT and the real world is significant in that it shows the integral role he assigned to CT in Physics. The critical thinking process facilitated the mapping of disciplinary methods to physical realities; thereby leading to understandings of the real world.

Despite making a case for situating CT in botany, within the predictability and repeatability of scientific and mathematical models, Brenda was also keenly aware that her discipline operated in a world with elements of unpredictability. Being a life science, she said “there was an element of unpredictability in biology; things fail as organisms just don't necessarily respond how you expect them to” (p. 7). She even argued that the unpredictability of the world was further accentuated when multiple organisms interacted with each other and the environment. In that, she sees her world as sharing territory with both natural and behavioral sciences. The role of CT in that world was to facilitate solving complex problems and to logically simplify complexity.

Philosophically, both Charles and Philip held views that aligned closely with realism. While they admitted to levels of unpredictability in the world, it was not the norm. In contrast,
Brenda painted a world that was intrinsically unpredictable in nature. In all cases, CT played a key role in their attempts to study the worlds they described.

**Assumptions on the nature of knowledge.**

As a logical outflow from their assumptions on the world and how it operated, emerged assumptions on how knowledge about the world is created and validated. At its best, the reality and predictability of the real world, combined with the use of scientific empiricism, logical and mathematical validity provided frameworks for the creation of two types of knowledge - laws and theories. While laws represented knowledge that was absolute, and unchangeable, theories represented tentative knowledge with varying progression toward absoluteness. On the nature of knowledge, Philip and Charles held similar but closely nuanced views while Brenda’s views stood apart. They also attributed different reasons as to why knowledge was tentative. In each case, it is interesting to observe how closely their assumptions tie in with the role they assigned to the CT process and to their disciplinary definitions of the term.

Philip carried the predictability he attributed to the real world to some types of knowledge. He argued, “There are some underlying laws that don’t arbitrarily change from time, I mean that’s a major assumption itself, but it seems to be borne out by observation. I mean, where would we be if physical laws that are described by mathematical relationships, where would we be if they arbitrarily changed from day to day. If gravity operated differently on Tuesday than it did on Wednesday.” Charles too held similar views on the absolute nature of some knowledge. He held, “There are certain laws that cannot be violated like the laws of thermodynamics, a perpetual motion machine is impossible. Any critical thinker would look at somebody who is trying to sell a perpetual motion machine and say, that's impossible because thermodynamically it’s absolutely impossible.” The highest form of science in physics and
chemistry was to use mathematical models to develop laws that accurately captured the reality and predictability of the world. Thus, “physical laws” also acquired the predictable, absolute nature of the reality it represented.

Hence, I was curious what role they assigned to the critical thinking process when truth was already defined. Philip held that most of the work in physics and a lot of the work in developing physical laws were about trying to simplify complex things so that we can actually understand the operation of the real world in terms of basic concepts. Since the world “always throws these things together” he argued, a major part of CT in physics or chemistry was in understanding the basic relationships in the real world. Hence Philip argued that good critical thinkers are “interested in the underlying principles and build everything out from the underlying principles.” Charles even argued that “part of CT is knowing what you don’t know and getting the facts.” This further explains the reason why faculty in the natural sciences placed extreme importance on acquiring disciplinary knowledge to be able to think critically in their disciplines.

Despite their hard stance on the predictability of disciplinary methods and knowledge, in their moment of weakness, they admitted that even in the natural sciences, nothing could really be proved. While Brenda remained silent on the absolute nature of knowledge, she chimed in loud and clear on the unpredictable nature of knowledge. They all held that the complexity of the physical and biological universe held more questions than answers. Their own research was approximations, and at best, the most plausible estimates of that reality. It was in this context, that for the first time, I heard them talk about plausible outcomes. Philip admitted, “Well no matter what, you know, how solid we think, there's a set of assumptions. Like I said, we assume everything is repeatable, that the laws of physics don't change from day-to-day. And that's true for most things, but is there some other; there is always the concern of unknown factors in there.
that throw things off.” Hence while defining CT he accorded a place of importance to being able to develop reasonable assumptions. Charles captured the tentative nature of knowledge eloquently well when he asked:

So what is true? The problem is we're scientists, right? We're taught that eventually theories will become laws, right? And most things are still theory, right? We don't understand everything, we understand many things. So what is true? You've got to be prepared; some things you think are true can change.

For Charles and Philip, the unpredictability of knowledge largely lay in the inability of individuals to understand the complexity with which the real world operated and ignorance of the unknown. It is interesting to point out the distance that they constructed between the world and the knowledge seeker.

The world that Brenda described held inherent elements of unpredictability. Therefore she admitted while studying plant migration and diversification patterns, she could only hypothesize or draw inferences about the past. In science, she said, “you can’t prove something, especially the past.” In addition, she pointed to the unpredictability of the methods used in her discipline. While working in the lab, she argued, one needs to place a lot of faith in the process and instruments. Despite the unpredictability of the world and methods, Brenda felt her discipline aligned more with scientific empiricism by being situated in mathematical, statistical and logical validity. Hence, CT in biology, as characterized by the ability to trouble shoot and solve problems was essential to success in the field.

Assumptions on standards to evaluate the process and outcome of CT.

Faculty in their role as evaluators of student learning constantly make judgments of student work and interactions in the classroom. Two important processes emerged about how
faculty judge the ability of students to apply CT. First, is the process of justification of conclusions and second, what faculty think should be the outcome of the critical thinking process. While faculty in the natural sciences unanimously and exclusively preferred mathematical logic and validity as the means to justify conclusions, their opinions on what should be the outcome of CT were markedly individual. Philip articulated the individuality of opinion that would emerge when he said, “I think if you get into our faculty meeting if you actually ask that in a well posed question where we actually understand what we're being asked, you'll get, 22 faculty who show up; you'll get 22 different answers.”

Interesting insights emerged when I analyzed the words that these faculty used to describe the outcome of the critical thinking process. Still leaning toward realism, Charles for instance, thought that CT was the ability to “decipher truth from untruth.” When marking distinctions between his discipline and the humanities, he said of the humanities, “you're not talking about black and white, it's all shades of gray.” He talked of disciplines that are more “subjective than objective.” He said claims were either “true or untrue in science.” It is insightful to note the definitive, binary nature of the words he chose to use despite admitting that truth as he defined it, had potential to change. His discomfort with duality of thought is revealed in his example of a colleague who believed that placing magnets in shoes would help heal joint pain and held that electromagnetic waves from power lines are causing cancer. Charles asked, “I mean you can't have a magnetic field that is good and bad at the same time. I mean, to me, you're just deluding yourself.” There was little role for ambiguity or duality within his understanding on the outcome of CT. To him, the CT process should lead one to truth or help uncover untruth.

Philip very deliberately avoided using the word “truth.” He turned my questions right back at me when I probed his statements on the matter. When I asked how he defined truth, he
retorted; “These are just tough ones for physics. I mean, what would you say in your field, your desired outcome is… I'll throw the ball in your court.” He preferred using words like mathematical, statistical, and logical validity instead of truth. He leaned toward algorithmic notions of truth and argued, “I think part of truth is mathematical validity…there are different properties and uses of numbers and some usages lead to more deterministic, mechanistic points of view.” His epistemic cognition is different from Charles, in that he recognized domain differences and differentiated between mechanistic and non-mechanistic paths to logical validity.

The test of good CT for Philip was “given mathematical models you use, whether that would really relate or map to the physical reality you're trying to describe.” He went on to argue, “I think critical thinking requires that you have a very good understanding of which conclusions you can draw on some statistics, what's the statistical validity of conclusions you can draw from any data set. People who get into trouble...where you see embarrassments are when people draw conclusions from data that they don't have enough statistics or randomness is able to, or flaws in the collection procedures.” Hence in his judgment, an argument or finding was valid or not, logical or illogical depending on its mathematical validity.

When talking about reasoning and logic in Botany, Brenda noted, “I think there are multiple solutions.” Critical thinking was the ability to “use your reasoning as well as your background information to come to (pause) ...uh, and of course, there are multiple answers sometimes as well, but to come to a sound result or resolution.” Interestingly, Brenda’s choice of words dramatically differs from Charles and Philip. It is important to note how Brenda paused to qualify her stance when she admitted that there could be multiple answers. Her use of the words, “result or resolution” revealed the unsure nature of knowledge and its outcomes. She argued that “really good critical thinkers understand every step so when something doesn't work, they can
back up and trouble shoot and go again in a different direction to make something work.” CT in her judgment was not as much about arriving at the truth but the ability to process multiple, complex lines of reasoning to arrive at the most logical explanation or resolution. Her stance recognized multiplicity of conclusions and provided scope for forming contextual judgment based on personal epistemology.

**Summary of finding 4.**

The above mentioned analysis makes it amply evident that these faculty drew from their personal epistemology and ontological cognition to both conceptualize CT, evaluate the process of justification and the outcomes of CT. Closely associated with the process of justifying conclusions made as a result of the critical thinking process were faculty preferences on the methods used to evaluate new or existing knowledge. Inherently tied to judgments on the outcomes of CT were notions that faculty held on truth and standards.

Situated within the scientific process, faculty in the natural sciences talked about the certainty of realities they studied and the certainty of knowledge within their disciplines. In that vein, they also talked about elements of uncertainty with the methods they used to establish knowledge. They saw CT as being involved with both aspects. As a deductive process that utilized statistical and mathematical validity, CT was necessary to arrive at truth or a conclusion. When dealing with the uncertainty of methods through which knowledge is created, CT was the ability to decipher truth from untruth and seek alternative explanations. At the same time, their epistemologies varied in their beliefs whether truth is attainable or the extent to which it is attainable. Each faculty brought unique perspectives to their judgments on the outcome of the critical thinking process. They were also cognizant of their differences and admitted that their colleagues in other sub-branches of their discipline would differ with them in their analysis of
CT. However, they found their bearings and room for commonality in being situated within the scientific process.

**Chapter Summary**

I can confidently conclude from this data set that disciplinary approaches, ontological assumptions and personal epistemologies influenced the way faculty from this discipline cluster conceptualized CT. I find it difficult to argue whether the nature of disciplinary approaches and methods cultivated and reinforced personal epistemology or whether it was the reverse. It would be fair to say that within disciplinary, educational contexts, faculty tended to focus on aspects of CT that were most relevant to their disciplinary needs. When gauging whether thinking is critical or evaluating the premises of arguments, faculty relied on their personal epistemologies to make such judgments. Their ontological assumptions influenced their understanding on the properties of the term CT thereby influencing the way they operationalized CT in their classrooms. I found that faculty from the natural sciences constructed their individual conceptualizations of CT as a result of a complex, interplay among disciplinary approaches and methods, personal epistemological assumptions, and their ontologies on CT.
Chapter 5

Faculty Conceptualizations of CT in the Humanities – Analysis and Findings

In this chapter, I present my analysis and findings on conceptualizations of CT held by faculty in humanities-based disciplines. In order to achieve disciplinary comparison and contrast within the humanities, I have used a combination of an individual and thematic approach to present my findings. I have used pseudonyms to identify each participant that begin with the alphabet of the discipline to which the faculty was affiliated. For example, Steve is a professor in studio Arts, Roseanne a professor in romance languages and Paul a professor in philosophy. This mechanism will help readers easily identify disciplinary leanings and at the same time give participant statements personal identification each time their ideas are referenced in this study.

Participant Profiles

Roseanne – Professor in romance languages.

Roseanne identified as Caucasian, female and had over 20 years of experience teaching in the field of romance languages. I entered her office and she welcomed me in. Her office was neatly decorated with tablecloths and artificial plants and vines ran all over her office. The décor created the feeling of being in a green, vegetated place. Her chair was squeaky but it did not seem to bother her. I found that she used the squeakiness as a prop with effect, to communicate when she was uncomfortable or when making an important point.

Her interview was the first I conducted for the study and it came with its nerves. The first part of my interview was uneasy. As with any meeting of strangers, she was gauging my intent. I could not read much from her non-verbal communication. She used difficult words and complex
sentence structures that were very lofty. Early in the interview I knew I had to put her at ease to get her to treat the interview as a conversation rather than a test of knowledge.

Several times during the interview she would pause to ask me if I knew the works of a philosopher, author or historian that she referenced or if I understood the phrases she used that were borrowed from European languages. I candidly admitted that I did not know them; to which she would exclaim, “Mother of God!” But I think my ignorance may have worked in my favor! We ended up having a very meaningful conversation. She even recommended my study to her colleagues. I wrote in my research journal that day, “I thoroughly enjoyed talking with Roseanne and learning her perspective.”

Steve – Professor in studio arts.

Steve described himself as an artist by profession. He worked with metals and jewelry. He identified as Caucasian, male and had spent over 30 years teaching in his area of interest. His office was tastefully decorated and his papers and files were neatly arranged. He wore small rounded spectacles that sat on the tip of his nose. It made him look very distinguished.

During the interview, he frequently slipped into long moments of silence and returned with a word, then paused before speaking again. It was not uncommon for him to pull out a piece of paper and doodle his ideas when I asked a question. During the initial stages of the interview, I tried to feed him with appropriate words and felt a little disconnected from his thinking. As the interview progressed, I learned to respect his silence and doodling. I just asked the questions, sat back, waited, watched with fascination, and listened when he spoke. His silence, I learned, represented moments of deep thought and reflection. I also made it a point to closely analyze the words he returned with after the long pauses. He clearly chose them very carefully.
He described metals and jewelry as “the window which I use to solve or create the objects that I make.” Conceptually, he said his work dealt with collecting and finding things and dealing with cycles in nature and finding relevance, parallels and metaphors. He saw his work and the range of materials that he used “to express his emotions” as evolutionary over the years. He described his professional evolution as a representation of his life as it involved exploring new things, capturing the “erosion or changes” in his life and showing how he was “part of that larger cycle of things.” Steve made it clear that he was connected with his work at a personal level.

**Paul - Professor in philosophy.**

Paul identified as Caucasian, male and had spent over 15 years teaching philosophy. Given that the philosophy department at his university housed courses titled CT and he taught for CT explicitly, he was on home turf when discussing CT. His office was well lit, with piles of journals lying around. He was very enthusiastic and pleasant to speak with.

Talking with Paul, in many ways, reminded me of some of the literature I had read on critical thinking. Paul struck me as candid and forthcoming with his views. I just had to ask the question and he talked for long stretches. As a true philosopher, he argued his case with me on every count and used compelling logical arguments to make his case. We ended up spending more time than scheduled for the interview, but we both enjoyed the conversation.

**Personal Definitions of CT**

After brief introductions and engaging participants in a discussion on their research agenda, I started out each interview by asking faculty members to describe, in their own words, what the term critical thinking meant to them personally. I also asked for real life, out of classroom examples of their conceptualizations. The goal was to examine and compare their
personal and disciplinary definitions, and to identify elements that influenced their conceptualizations of CT.

Roseanne defined CT as “the ability to make distinctions…being able to qualify or see differences and distinctions and to analyze and modify and to understand a thing. I think that generally is critical thinking.” She used reading a newspaper as an example of CT in everyday life. CT in that context she argued involved seeing nuances of opinion or representation particularly if certain things were omitted based on who is writing and the audience. Highlighting the role of context in CT she argued, “A critical thinker would weigh words and contextualize what they were reading. They would also automatically play the devil’s advocate and ask the other side, and wonder if the author took that into account in the writing.” Her definition and example emphasize aporetic and contextual elements of CT. She held that CT involved asking questions – “Is something being kept from me? Has the author thought this through and questioned it themselves?” Interestingly, the goal of CT for her was to “gain an understanding of something.”

When I asked Steve for his personal definition, he complained, “Well, I … kind of, it’s hard for me to separate that. My mind instantly starts going to applying it…and then I instantly start to steer it down to those things.” As a process, he said, “critical thinking is something that has to be applied to a subject for me. So, um, and I guess it’s so dependent upon what that is…” Steve defined CT as “analyzing and breaking down the components of whatever the subject is in some kind of manner…critical thinking is a process of trying to come to understanding to make a decision or resolve something.” His notion of CT as analyzing and breaking down were key to facilitating the creative process. His strong applicational stance and use of words like “trying to
develop an understanding of whatever the subject is” and “resolve something” to describe the outcome of the CT process need to be noted at this stage.

He thought the process of buying a car was a good example of CT. For him, it involved cognitive processes like researching the resale value, the mechanical history of that particular model, its availability, its market price, and test driving the car. He explained, “It’s not purely a cognitive process. I mean if we were talking about the car, there’s an aesthetic kind of appreciation of it, as well.” He added that the process of “looking, experiencing and researching were part of the critical thinking process.” Therefore, rational logic was a platform he used to launch the CT process. CT, in his assessment, used a combination of logical, experiential and aesthetic elements.

Paul defined CT as the “ability to comprehend, articulate, analyze, and then produce a premise-conclusion argument, where the ideal is a formally valid argument.” He defined a formally valid argument as one that used procedures of mathematical validity to arrive at truth. When I asked for an example of CT in real life, he said, “A good example of this thing is what happens in judicial opinions where there is a huge argument over how to interpret text and how to apply the consequences of that and play back and forth between each other and people have strong opinions of how that all plays out.” It is interesting to point out at this stage that his definition and example seem at odds. While the CT was a process that led to objective truth, his example of CT highlighted the interpretative nature of truth. It is important to note this contrast.

Analyzing their personal definitions of CT, Roseanne and Steve thought CT involved logical processes and experiential and aesthetic elements that lead to better understanding or resolution of something. What stands out from their personal definitions was how closely CT was connected to context and self. Both of them used the word “organic” when referencing the
role of self in CT. Paul stood out from his colleagues in the humanities in that he took a rationalistic and skilled approach to CT. However, the contrast that emerged from his personal definition of CT and his example of CT called for closer analysis of his stance.

**Thematic Finding 1: Faculty Viewed CT as Tied to Disciplinary Thinking, Content and Methods**

**Paul – critical thinking is the ability to use formal logic to establish validity and soundness.**

Paul held that CT in Philosophy involved two logical processes – formal logic and informal logic. He held that when CT is taught as a course by itself, out of a philosophy department, it uses notions of formal and informal logic. Informal logic focused on issues that pertained to philosophy and to a wide variety of cases like political or journalistic issues. He said that the goal of CT in informal logic was to apply reasoning about logical fallacies or uses of rhetoric to units of basic ideas.

When taught implicitly through philosophical content, CT involved formal logic. He explained formal logic as reasoning that focused on determining the validity of the premises of an argument to arrive at a conclusion. CT, when seen as formal logic, assumed that lines of reasoning could be formalized or nearly formalized. He held that formalization of logic involved the mathematization of logical processes and procedures. This formal process, he argued, if true, when applied to premises of arguments, would make the conclusion of the argument true or very likely. He described the goal of formal logic as “stripping out what you might think as emotional parts of the rhetoric that appeal to people’s personal values as opposed to their beliefs and their evidence.” Formal logic to him represented the ideal and the highest form of reasoning.
What also emerged from his disciplinary understanding of the term were strong structural or procedural elements of CT. On account of a heavy focus on skill and procedure, his approach for creating critical thinkers involved practice. These excerpts showed the emphasis he placed on repetition and practice. “CT is something people get better at with practice;” “I mean practice, practice, practice which is writing and speaking about these texts;” “What we’re trying to do is by lots of practice to get people to where they draw and naturally come to draw these distinctions that in the beginning we have to point out;” “I say that the objective of my courses is to learn and practice critical thinking skills.” Consequently he used memorization of the procedure and quizzes to test for ability and agility of students to reach valid and sound conclusions and to do so quickly. The implication was that memorization and practice of the procedure could make an individual a good critical thinker.

What emerged from his approach was a hierarchal value for a set of rationalistic skills and the presence of formulaic processes. Becoming a good critical thinker involved not just mastery of skills but mastery of the process itself. The heavy emphasis he placed on logical, rationalistic processes and the procedural approach prompted me to conduct a cluster analysis in NVivo 9.0. of his use of the word logic. These examples show different usages of the word that showcase his approach to CT. The phrases “logical reasoning,” “logical validity,” “logical argument,” “formal logic,” “complicated logic,” “formalized logic,” “symbolic logic,” and “deductive logic” show the types of logic on which he focused. These phrases demonstrated the structural nature of CT: “logical structures,” “logical symbols and notations,” “logic puzzles,” “logical relations,” “logical path of reasoning.” He used these phrases to describe the criteria to evaluate CT: “logical merit,” “logical reasons,” “logical sense of validity,” “unsound logic,” and “logical fallacies.”
It is important to point out how closely his approach in the classroom reflected his conceptualization of CT. As a philosopher he was generally interested in a student’s ability to take philosophical texts, identify premises and conclusions and be able to evaluate the arguments in terms of whether the “premises are apt for supporting the conclusion with the ideal case being a formally valid argument.” Therefore, he said, “In the first two weeks of class I give them explicit definitions of logical validity and soundness and explicitly tell them they can expect that this will show up over and over on quizzes and exams and soon after that ask them to either state them or use them on quizzes…and you say, this is going to occur over and over, we can ask you about this again on every course and exam and frankly even on the final exam.”

He was well aware of the limitations of treating CT as formal logic. He admitted, “I think that in some cases formal logic is quite useful in that it’s a great tool. But in other cases, because of the constraints of formal languages and their interpretation, it can be quite misleading. In addition, the truth of the matter is that lots of people are not at the level as the philosophers to process very complicated logic. And so in those cases the formality tends to obfuscate rather than clarify and everybody just ends up translating what was said into ordinary usual English to understand it anyway.” Despite the limitations and lack of value he attributed to formal logic, he still used it as the primary means to teach students CT in philosophy.

Speaking on the efficacy of his pedagogical efforts, he held that “the ability of students to apply definitions of validity and soundness to simple examples is well lower than his expectations.” He asked, “Why can’t we get undergraduates to remember one sentence? If you tell them ‘remember,’ you think they’ll be able to remember it. That part is disappointing.” Interestingly a hopeful pedagogical approach emerged in his approach. He admitted, “By the end
of the course, certainly, most of our students are doing pretty good on CT. Whether they remembered it long after that is another question.”

Steve – critical thinking is the ability to examine multiple perspectives and explore the past.

Steve started out by telling me that jewelry making, as a discipline, could be seen through multiple lenses. As a craft which dealt with function, form and materials, it involved how well something is made. Through the filter of fine arts, jewelry making focused on the esoteric and could very well deny the criteria used by crafts. As a performance art, it could acquire new dimensions. This description highlighted the multiple layers of context that he dealt with as an artist and professor even in framing his discipline.

As with his personal definition, he found it difficult to talk about CT without a specific frame of reference. Broadly defined, CT involved asking questions, gaining multiple perspectives and having a breadth of experience. He held that CT helped in developing a “holistic view of a situation” and “understanding something in the entirety of its existence.” He argued that there were multiple paths to arriving at a conclusion and context would determine that path. Hence, the evaluation of CT in his field depended on context and how one sets up the lenses.

Steve came up with a rather interesting list of components of CT. In addition to cognitive elements, he identified tactile, experiential, and sensory elements. He argued that these elements of CT brought genuineness and authenticity to an artist’s work. He said, “As an artist, you know, I delve and deal with these components all my life in many different ways.” CT involved looking at things, “not just coldly, but humanistically.” He argued that such an approach “gets to the core of somebody” and that it was difficult to get at the core using a purely “analytical way.”
As the examination of multiple perspectives, he defined CT as the ability to put oneself into multiple frames of mind and points of reference. He argued that the process would broaden one’s perspective. Within jewelry making, gaining a broad perspective involved examining how different people approach wearable art and the body. He argued what might seem great for the Norwegians who really appreciate extreme minimalism may not be appropriate for African cultures that use jewelry to adorn the body using different means, for different reasons. A critical thinker would need to look at how people, cultures and time periods have dealt with the adornment of the body in some way. Critical thinking in that context involved finding inventive ways to connect the past or a culture with the work being produced.

He was keen to point out that the adornment preferences of the Norwegians or Africans were neither right nor wrong. However, in his opinion, there were paths that lead to why some approaches are good solutions for specific people, cultures or environments. He held, “So when I look at critical thinking, I think about trying to analyze all of those scenarios in a way that shows you many different truths.” A good critical thinker would ask questions that could lead to a better understanding of the subject and help in the appreciation of difference.

Steve also placed emphasis on expanding one’s experiences. He argued since CT in jewelry making involved expressing oneself, it was important for a critical thinker to engage in a breadth of experiences. Speaking about some of his students he said, “A lot of times they do whatever is in their head and I’ve heard it so many times in my life that they don’t want to see anybody else’s work or learn about anybody else’s work because they want to make their own thing. But the thing they don’t realize is what they’re making is only what they’ve experienced and for most of them it’s a very minimal kind of exposure.” Consequently, he held, minimalistic experiences lead to minimalistic levels of CT.
His pedagogical approach to teaching CT was practical. It involved “showing past and present work in the classroom, trying to show a whole range of ways of expressing oneself through art or what interests oneself in art, and how you can learn more about it.” Therefore his approach valued individual points of view, perspectives, and styles that made individuals unique. He described CT as represented in his discipline as a process that “bakes and grows.” He saw his role in “facilitating their development as critical thinkers” and “watching students think.” Despite his nuanced approach, he too did not use any direct means to assess for CT. He said of his students, “Well, hopefully they’ve become wiser.”

**Roseanne – critical thinking is the ability to mark distinctions and ask questions.**

Roseanne defined CT as the ability to come up with a coherent argument, set of analyses and contributing facts, and then a well-reasoned and verbalized conclusion. She said it is the ability to mark distinctions, ask questions and recognize difference. She held that within her discipline CT was both evaluative and communicative. In her descriptions of CT as evaluative and communicative, I heard different voices – sometimes, discordant voices. So in the interview, I played devil’s advocate between her seemingly contradictory views in an attempt to understand how she made sense of them.

Each time I listened to the recording of my interview with Roseanne, I found that when I thought I understood her, I lost her. However, while analyzing the data the discordant views made sense. I selected Roseanne for the interview because she taught in the romance languages department. As it turned out, she was also a historian of classical literature. As a historian, she saw her discipline through two lenses – the humanities and social sciences. As a result the role she assigned to CT depended on the lenses she wore. She admitted, “I approach CT from two angles - one, from romance language because this is where I am, but secondarily I’m a historian.
So I look at it in terms of analytical thought, specifically persuasive, rigorous analytical thought usually leading to a structured completion or point of view.” Roseanne started out the interview talking about CT in history and its pursuit of truth. Midway, she decided to wear her linguistic hat. In that role she talked about the subjectivity of language and the role of meaning and individual and cultural truths.

CT when seen as evaluative was “very interested in balance and difference.” Historians, she argued, had the burden of looking at both sides and an “obligation to seek and to also document where it [difference] might not exist.” Critical thinking in that context involved “weighing words and contextualizing what one was reading.” The goal was to be able to make sense of “the spirit of the age” that could be deceptive at times or can be honest at times. Therefore she argued, “The primary thing is to tell the truth – to make every effort to express and explain the truth and structure so others can access the information we’ve gained.”

As a linguist, she saw a role for CT in multiple contexts. Structurally, the use of language involved vocabulary and grammatical structures and how they all fit together. This determined how one “crafts analysis or essentially a meta narrative.” She held that CT in that context involved “the habit of standing outside your sentence and parsing or diagramming it mentally.” She held that the process “forces students to think about they are trying to say.” She also held that critical thought in linguistics is best developed by exposure to multiple languages and cultures.

She reminded me, “I am a humanist, so the ability to put thoughts to words is important.” Hence, whatever was the goal of CT, the ability to communicate was absolutely essential. She argued, “If you have a great idea and you cannot express it in any language, either human or social or numerical, you have a problem.” However, she held that communication need not
necessarily have a specific purpose. “As the expression of self, it is declarative and subjective.”

Using the Chinese legal system as an example she said, “I find it absolutely fascinating because
the object there is not to, as we would say, to find the truth or develop equity or to achieve justice
but nearly to classify.” Recognizing the role of meaning in communication, she acknowledged
the subjective challenges that linguistic communication placed on CT. The goal of CT, she
argued, involved being true to self in the expression of thoughts and ideas. She held, “It doesn’t
necessarily have to be true, except for you emotionally.” Her understanding of truth as a linguist
is in contrast to her view as a historian.

Speaking about her pedagogical method, Roseanne used the Socratic Method to teach her
students CT. She said, “I ask them a lot of questions and I try to get them in the habit of asking
me questions.” She worked to “ground students in the experience of a civilization or a moment in
the history.” To achieve this, she would have her students read 3 or 4 monographs. This
approach, she said, exposed students to “different points of view and different vectors of attack.”

Roseanne was keen to highlight the everyday value of her approach to CT. She said, “If I have
someone who has basically learned to read a newspaper and listen to NPR and FOX news at the
same time and then decide where the holes are in both analyses, I believe I’ve succeeded.
Whether I create a new PhD or an adult who can think and direct their lives effectively, in both
cases I’ve created a critical thinker and I’m proud of that.” I asked her to describe her goal in
teaching for CT. She replied, “I want them to reach something. A number of them don’t try to
reach at all and that’s a tragedy. If they want to reach an odd or bizarre truth, that’s alright too, at
least it’s activity.”
Summary of finding 1.

As pointed out earlier, the lives of faculty in the humanities were tied up with their craft or profession. Their discipline represented an expression of self, and was organic to them or an extension of their lives. Hence a separation of the two caused them discomfort. I found that the personal definitions that these faculty used to define CT were analogous with their disciplinary definitions and approach. Nonetheless, the preponderance of evidence presented above showed that faculty focused on elements of CT that were applicable to their specific disciplinary contexts.

However, two discordant findings emerged from this section which need to be addressed and analyzed closely. First, Paul from philosophy took a strong rationalistic, objective stance to CT as a process and outcome. In line with disciplinary trends he adhered to formal and mathematically derived logic and structures in his pedagogical approach to CT. Yet he said the best example of CT was evidenced in judicial cases which involved interpretation. It appears at this stage that his personal beliefs are at odds with his definition and approach to CT in the classroom.

Roseanne in many ways epitomized the influence that disciplinary content and methods have on an individual’s conceptualization and approach to CT. In her dual disciplinary capacity she applied CT and focused on separate skills and dispositions depending on the disciplinary context. She also held different standards for evaluating CT in different contexts. As a historian she spoke extensively of truth and the quest to prove things like mathematicians and natural scientists. As a linguist, she held that CT was involved in communication and expression of self. Therefore truth was defined by the individual.
She dexterously moved between approaches to CT while maintaining disciplinary distinctions. Her dual approach raised analytic questions on the role that personal epistemology played in different disciplinary contexts. How did she align her seeming notions on truth and subjectivity? Were they consistent across her disciplinary approaches or did she compartmentalize her approach to CT? These are analytic questions that I will discuss when dealing with Roseanne’s personal epistemology later in this chapter.

**Thematic Finding 2: Faculty Assumptions on the Ontology of CT Influenced Conceptualizations of CT and Classroom Practice**

While describing their understanding of CT, faculty in the humanities expressed views on the nature of CT. I found that the ontological assumptions that they held on the nature of CT influenced how they approached CT in the classroom and so I extracted these assumptions for a separate discussion. While disciplinary influences are also seen in this section, the influence of faculty ontologies of CT stands out.

**CT is dependent on context.**

Faculty in the humanities were keenly aware of the contextual nature of CT and argued for the role of context from interesting vantage points. Steve argued that context would determine the type of thinking or the type of thinking skills required in a situation. He said, “Often times, there are many answers to a question.” In his example of buying a car, he said, “There are very specific things that I know I want about a car and so I’m kind of funneling my thoughts toward a certain direction based on my own wants needs or desires.” In the classroom, he argued, “There are certain kinds of criteria that we’re actually trying to focus on and so we head down that path.” He argued that critical thinking was “a very general subject to understand.
fully, I think you have to put yourself in many different states of mind and scenarios in order to understand that subject well.”

Right at the start of her interview Rosanne told me, “I’ve been teaching since 1975 and it’s marked in how different the conceptualization of critical thinking is. So I think it’s a matter of each generation’s imprinting as opposed to their innate or essential qualities.” Therefore she argued that CT is the product of “zeitgeist or the spirit of the age” rather than a procedural process. She used an example from the course she taught in witchcraft persecution. She said, “The history of framing and prosecuting witchcraft is a fascinating look at the development of critical faculties in differing contexts over hundreds of years in European history. For one thing, it went from the religious to the juridical and from that to the scientific.” When CT is seen as zeitgeist, she argued, “CT shifts as the cognition, zeitgeist or the spirit of the age changes across the society.”

Roseanne also pointed to the context of the thinker as determining CT. She said, “One of the most fascinating things is seeing individuals interpret texts. I mean, the rabbinical court is a classic example of it; in fact, all legal setups are.” She argued that those legal systems showed how individuals are “exercising critical faculties within their own context and milieu.” She argued that CT in her discipline was not necessarily about drill or something of that sort, but you have to be able to see context and various applications.” Pointing to the lack of varied approaches to CT, she said, “Our presumption of the democratization of all communication and knowledge is a bit of a pitfall because it doesn’t take into account at all that individuals have different capacities and interests.”
**CT required broadening of perspective and experience.**

The role that faculty in the humanities assigned to CT in their disciplines revolved around everyday themes and milieus. Most of the examples that they used were drawn from media sources like newspapers, FOX news or NPR. They saw CT as a skill that transcended the classroom to life. Roseanne argued that CT was involved in becoming an intellectual – “If you learn to think, to present, to argue and to be honest when you argue, you are achieving critical thinking.” Steve saw CT as part of the process of becoming “wise.”

Integral to developing critical faculties in the humanities was broadening one’s perspective by studying the past and making metaphorical connections. Steve argued that a critical thinker was one who was able to “think about past, understand it and link the present with the past using metaphors.” He used the following example to make his point. He said that in projects that he gave his students, he required that they research and think about either how that object is to be worn and used, or relating back to history and reinventing a use for something. To do this he argued, “You have to know what it was originally, and how it was used, like a châtelaine, for example, which is a Victorian element that was hung on clothing that had, you know, scissors and thread and keys to open the door. Well, what would a contemporary châtelaine be? So one has to think about past use and understand it but also, today, maybe it’s a flash drive, maybe a flashlight, car keys, or the things that we use in a daily life.” Consequently he argued, “In my mind that’s critical thinking because you are not only problem solving, but you’re also learning about.”

Roseanne articulated similar views. She talked about a paper that a student submitted that epitomized the aspect of CT that involved linking the past with the present. She said,
I received a paper in my witchcrafts studies class that was marvelous. We were dealing with the whole idea of the supernatural in Western history although we’re also doing African witchcraft. One of the things that interests students is the notion of the oracular or divination…this student came up with something I hadn’t even thought about. She was talking about a type of quiz now that exists on Facebook by which you answer certain question and the algorithm gives you what supposedly is the initial, the first letter of the word of the name of somebody that you would likely hook up with. That is a variation in a computer form of a very old form of divination they used to practice in the dark ages where they would peel an apple and make sure it was a continuous peel and then under the right circumstances, usually midnight while looking into a pan of water, they put it over their left shoulder and turned around and the letter that it formed would be that first letter. You see what I mean here? This student saw how technology was still coming together to satisfy what apparently is a primal human frivolous urge. That was brilliant I thought.

As is evident, both Roseanne and Steve, in their disciplinary contexts, were articulating the importance of metaphorically linking the present with the past. Hence their focus was not on the memorization of content but the acquisition of broader skills and dispositional capabilities that could help students navigate the changing realities of their worlds.

**CT is integrated with other learning outcomes.**

All faculty in this discipline cluster strongly held that CT was integrated with learning outcomes that involved communication, comprehension and articulation of thoughts, ideas or self. Faculty in the group discussion complained that often they have students who had not learned to write and as a result were unable to communicate their thought processes.
Roseanne argued that CT was “the ability to come up with a coherent argument, set of analyses and contributing facts, and then a well-reasoned and verbalized conclusion. That’s what I’m aiming for with critical thinking if I want to use a romance context.” Given the importance of communication in her discipline she said, “I think that it’s necessary to have a felicitous and elegant expression and a good use of the language in a language course, particularly in romance languages.” The importance she placed on it is evidenced in this statement: “People who don’t learn clarity of expression are hobbled for life.” She saw the relationship between CT and her discipline as reciprocal. CT enhanced communication – “Obviously, communication is worthless unless you assess a certain value to it because all of it is not equal. All of it is not the same.” At the same time good communication enhanced the expression and appreciation of critical thought.

When I asked Paul to define the components of CT, he said, “First there is basic ability to comprehend some text or some idea or some spoken discussion. No, actually I think the first stage is to be able to read and understand.” Within philosophy, it was important for students to be able to first read a text in its most general form and understand the author’s approach. It was only then that students could move to the next step which he described as “analyzing, breaking ideas into its pieces and deciphering points of view.” Then he held they should be able to articulate their thoughts so that somebody else could understand it.

Despite the heavy emphasis that they placed on the ability to communicate critical thought, these faculty acknowledged that it was possible to think critically independent of the ability to communicate it. Roseanne articulated this view: “There are individuals who are capable obviously of great critical thinking, but they cannot readily offer it up to other people. It’s difficult for them, so they tend to gravitate into certain fields because jargoning exists and they
can specifically indicate what they are trying to say.” This finding was also echoed by faculty in the natural sciences and its implications for assessment will be considered in chapter eight.

**CT involved aporetic elements and the use of linguistics.**

Despite their differences in approach to CT or their views on the outcome of the CT process, faculty from the humanities largely focused on the aporetic elements of CT. They all thought that identifying, recognizing and appreciating difference was an essential element of CT. Irrespective of their opinion on where questions should lead students, they were unanimous that questioning and skepticism were part of critical thinking. Steve held, “I think it’s asking questions…and hopefully the questions lead you to a better understanding.” Highlighting the importance of teaching students to ask questions, Roseanne said, “If you don’t ask them to question, if you don’t show them how, it’s not surprising that they won’t.” A common theme was that CT involved breaking ideas, concepts, arguments, and problems into their components, making distinctions, classifying information, seeking multiple perspectives and broadening personal experiences and the ability to see and appreciate difference.

They all identified language as the primary means of communicating critical thought in their disciplines. They acknowledged, in varying degree, the role that logical rationalistic elements of CT played in their disciplines. However, given that they worked primarily with cultures, languages, beliefs, ideas, arguments and historical events, CT acquired new dimensions beyond cognitive skill. They acknowledged the subjective or relative role that language brought to their disciplines. They deployed various approaches to deal with relativity and subjectivity. Steve embraced it. Roseanne approached it differently depending on her disciplinary lenses. Paul used a rationalistic procedure to strip arguments of personal factors.
These faculty also took a strong dispositional stance to CT. Roseanne held that critical thinkers “tended to be ones who are interrogative but cautious in the same way.” They would develop “the habit of curiosity” and “develop their own filters.” These characteristics would help create self-sustaining active critical thinkers. They all talked about the CT process becoming organic to the individual. They argued that CT had to become a personal possession for it to be meaningfully applied beyond the classroom.

**CT is a developmental process.**

Faculty in the humanities viewed CT as a developmental process. Paul saw CT as a cognitive process that involved “building up of skills.” He held that the skills of CT “build on each other.” As a matter of pedagogy, he held that “it is important to not hit them at first but try to get them engaged with some kind of content before we focus on the structural stuff. When we go to approach the structural stuff we introduce them to the definitions of validity and soundness and then start with toy examples where it is easy to see whether an argument is valid or invalid, sound or unsound…. by the time they go into upper-level courses or graduate courses or something, they get into all the messy details of exactly how to go about interpreting big texts rather than little pieces of complicated arguments.” Paul’s approach to CT involved pragmatism and it highlighted the developmental approach he used to CT when dealing with freshmen and upper-level courses.

Faculty who saw CT as the expansion of perspective and experience pointed to the developmental nature of CT. This theme was also reinforced by participants in the focus group discussion. Steve held that limited experience leads to limited critical capabilities. His pedagogical approach exposed students to diverse experiences with a progression toward complexity. I asked him why CT was important in his discipline, and he responded, “It forces the
issue of looking to learn more because every time you expand and learn, the more liberated you are, the more skills you have, the more knowledge you have, the closer you’re going to get to your own kind of work. I’ve seen it time and time again.” As is evident, his understanding of CT as developmental was not necessarily cognitive. His use of words like “expand” and “liberated” represent for me a higher state of consciousness.

Summary of finding 2.

The ontological assumptions that these faculty held provided interesting insights into how they constructed the fundamental properties of CT. As has become evident from the above discussion, there is a strong association between the ontological assumptions that these faculty held on CT and their stated pedagogical approaches. Unique to this faculty group was the emphasis that they placed on the aporetic elements of CT and the position they assigned to rationality. This finding re-affirms findings from faculty in the natural sciences that studying the ontological assumptions that faculty hold on the nature of CT can provide a good barometer of their understanding of the term.

As in the natural sciences, what also stands out is the unanimity of opinion that was expressed. Many of the ontological elements of CT that emerged from individual interviews were validated strongly by participants in the group discussions. It is also evident how closely tied their assumptions are to their pedagogical approaches. It also highlights the need to align curricular and assessment approaches with how faculty approach CT.

Thematic Finding 3: Faculty used Personal Epistemology to make Judgments on the Outcomes of CT

As with faculty in the natural sciences, I found that faculty held unique perspectives on CT that were connected with their personal epistemologies on the nature of knowledge and
knowing and truth. For clarity of this discussion, I used the term personal epistemology (see chapter two for definition) to encompass faculty assumptions on the nature of the world, the nature of knowledge, and the standards used to make judgment on the outcomes of the critical thinking process.

At this stage, I must mark distinctions between standards that faculty used to evaluate the process of justifying knowledge and their opinions on what should be the outcome of the critical thinking process, with the formal methods/approaches used to assess for CT. Their personal epistemologies were evident in the process of justification and their expectations on the outcome of CT process rather than in the formal methods they used to assess for CT. This was largely true in this data set because faculty admitted that they did not explicitly assess for CT but did so implicitly through other disciplinary assessments. Hence I will discuss the influence of their personal epistemologies on CT in this chapter. The formal assessment approaches that faculty used are discussed in chapter six.

**Assumptions on the nature of the world.**

Since the framework of this dissertation is set in an educational context, the worlds that faculty described were grounded in their disciplines. That said, as was evident when analyzing their personal definitions of CT, these faculty were organically tied with their disciplines at a personal level. Hence the worlds that faculty from the humanities described had elements of objectivity, subjectivity and relativity. They described the components of their world as culture, language, beliefs, ideas, arguments and historical events.

Paul stood out in the humanities in his strong acknowledgment and engagement of objective realities. He refused to acknowledge that the world contained subjective elements. He called me out several times during the interview for using the term “subjective” to describe the
world or events within it. Here is how he retorted to my use of the word subjective to describe content in his discipline: “Well, I don’t like that word and I wouldn’t say it is subjective.” He largely held to positivist notions of the world and held that individuals brought relativity in their understanding of the world.

Roseanne as a historian leaned heavily toward the notion that there were truths as contained in historical events and that truth could be accurately described. In her world, she was either an observer of actual events or had to make meaning of texts that contained past events. However, the world that she described was different from Paul’s in that it held truths that were the actions of individuals and which involved interpretation and the use of individuals and languages to explain truth. There was a level of engagement of the individual even in the actions of her world. She held that a certain level of objectivity could be reached by maintaining sufficient distance from the world or the subject of study.

As a linguist, she described a world that was constructed by individuals and cultures with language and elements of subjectivity. As a result, there were predictable and unpredictable patterns in the constructed world. Acknowledging the human factor in her world, she said, “At times you will see passion, emotion, the accident of the great man or a misunderstanding causing something that is not positivistically likely, unless you put the people in.” A good critical thinker in that context would make distinctions and classify observed patterns in the world.

The world that Steve described was intrinsically human but it contained objective realities. However, the realities that others described as objective were metaphorical to him. Reality for him existed in the individual rather than as an external entity. The ideal in his world was one where there was no distance between objective realities and individual elements. As will
become evident, objective realities were tools that individuals used to create other truths. It was the basis on which the esoteric, creative and critical faculties operated.

**Assumptions on the nature of knowledge.**

As an outflow from the nature of the worlds that these faculty described, coupled with the role that individuals, cultures, language and meaning played in their discipline, these faculty acknowledge that the nature of knowledge in their disciplines could be objective, tentative, relative to context, and subjective, with elements of truth and deception. Consequently, experiencing, defining, classifying, researching, and questioning were key ways of knowing the world and thereby creating knowledge. Integral to their understanding was the role that individuals played in establishing knowledge.

Interesting distinctions emerged when I considered the role that they assigned to self in the creation of knowledge. The approach that Paul took as a philosopher stood in contrast to others in the humanities. He argued that individuals had “a tendency to analyze texts in terms of the claims that resonate with them or that they find attractive or that are made with powerful and rhetorical force.” Therefore, he focused on stripping rhetoric and emotion and looking at the evidence presented, the specific claims that were made and the specific reasons that were offered. His faith in the logical, mathematical process becomes evident in this exchange:

**Mark:** You do have this very logical approach to teaching critical thinking and then you lead them onto this path where that process may not lead them to the truth?

**Tom:** No, no, that process will lead them to the truth. Whether you can in fact have all the necessary information to get all the way there is another matter.

In Paul’s estimate, knowledge existed outside the individual. The ideal in philosophy was to find truth and CT was the process through which truth could be found. Nonetheless, he
acknowledged, “We often fall short of that ideal so you may have an argument that only raises the probability of the conclusion without actually ensuring that it is true.”

Steve, on the other hand, argued that CT involved elements of logical reasoning but there existed elements of knowledge in his discipline that could not be processed solely by analytic means. He captured this in an example of buying a car. He talked about researching the model, its fuel usage, durability, and resale value but then finding there could be four cars on the lot of the same color, make and model, but one could feel better on the test drive, or appeal to him more aesthetically. CT to him was involved in all of the above processes – logical, esoteric, metaphoric and creative. He spoke of an interesting interplay between objective realities and his interest in them as an artist. As a teacher, he said,

I encourage students to look at the objective qualities of a material such as lead, which is not magnetic, it’s heavy, it’s dense, it repels radiation, and so it’s protective and at the same time it can kill you and so there are all these qualities and that’s sort of what art is made from. By analyzing or looking at what a material is, and then using those qualities to help conceptually patch your idea in some other way. So if I wanted to do a lead house, in form, it is different than if I made a house out of gold. Same size house, you know, um, the two side by side say totally different things. This is because of their materials and the objectiveness of those materials sends a message.

He added that there were other objective considerations for an artist, like where the metals were mined and the impact that mining had on the environment, that send important communicative and symbolic messages through art. It was fascinating how he turned the objective qualities of metals into metaphorical symbols. Therefore, he argued, subjective and objective elements were relevant knowledge, but objective knowledge “is utilized and applied in
other ways. Maybe more poetically if you will. We use those truths to create other truths, who knows...” Steve’s approach acknowledged and embraced the role of subjective knowledge as represented in perspective.

As a linguist, Roseanne viewed structures and vocabularies in language as objective elements of knowledge. Contrasting the objective and variable aspects of language, she said that as a historian, she held to empiricist notions of knowledge. Such knowledge did not have properties of absoluteness and was assumed to be accurate until proven wrong. She argued, “If you encounter something that doesn’t fit the truth, you have to modify it. If the data or the circumstance doesn’t fit, you must find a way to make the thing relatively coherent.” Hence, content existed as knowledge in her world until it was proven wrong.

As a linguist, she acknowledged the existence of knowledge that was empirically established and knowledge that was constructed as expression of self. These two forms of knowledge had different standards of evaluation. Showing the empiricism in language, she held, Roseanne: English does not appear rational to the non-native speaker. Of course, I think all languages probably have their limits in that regards. We’re accustomed to believing that there are immutable principals that are set up for language. And actually they are very mutable and that’s our problem. It’s the differences that make us nuts. But we have to understand the differences in order to communicate, particularly with subgroups. Mark: What do you mean by differences? Roseanne: You come up with a rule within a language and then you immediately turn around and say it doesn’t apply. For example, when you spell the word receive in English, I before E is the rule; except after C. Why should that be? You know, but it’s one of them. We have many others. And other languages do the same.
Yet she argued that when language is seen as communicative or a means of expression, truth was subjective and the assessment of it was whether it was true to the individual. She acknowledged that “people and language are both highly variable and subjective.” In this, her notions of knowledge aligned well with Steve.

**Assumptions on standards used to evaluate the process and outcome of CT.**

Two important sets of assumptions emerged from how faculty made judgments on a student’s application of CT. First, they held assumptions on the process by which knowledge claims are justified and second, assumptions on what should be the outcome of the critical thinking process.

Interesting insights emerged when I analyzed the words that these faculty used to describe the outcome of the critical thinking process. As a philosopher, Paul primarily worked with words to articulate ideas and arguments. He leaned heavily, however, toward the use of mathematical logic and validity as the means to justify knowledge claims. For him, truth had properties of relativity but the ideal outcome of the CT process was to reach objective truth. Even in its relative form, truth held elements of objectivity.

I would not say truth is subjective. Truth might be relativized to context … Whether some statement is or propositions are true or false is not up to us. It might be dependent on the world for a variety of ways but it does not make it subjective. It is still an objective fact. So truth may be relativized without being subjective.

Paul’s statement showed that he held that objective truth existed outside the individual’s perception of it. Individuals may experience or interpret objective truth in a relative manner. However, that perception does not change the objective properties of truth. Consequently, when evaluating for CT, he was generally interested in a student’s ability to take some texts, to identify
premises and conclusions and to be able to evaluate the arguments in terms of whether the
“premises are apt for supporting the conclusion with the ideal case being a formally valid
argument.” At this stage, I asked Paul if he had a personal theory on truth apart from the one he
used in his discipline. He responded, “I myself, I’m not sure I have a worked-out view of what
truth is. I am attracted to the view of a friend of mine who is a pluralist about truth. He thinks
that there can be different notions of truth in different discourses.” This confession posed
analytic problems as his expressed personal epistemology was not in line with the positivist
stance that he held throughout his interview. It needed closer examination and explanation and I
will undertake such an examination later in this chapter.

Steve, as an artist, used words like “resolution,” “understanding,” and “summary” to
describe the outcome of the critical thinking process. At some level, he was uncomfortable or
unsure with even defining the outcome of CT, saying, “I don’t want to say culminating the
experience, but defining, um, I’ll say defining or summarizing. So, I don’t know, just kind of like
that. It [CT] is a process of, um, several different things that lead to some kind of summary
about, um, whatever it is that you’re looking at.”

Nonetheless, he also used the word “truth” and spoke of the existence of the “real.” His
focus when it came to truth was on individually and socially constructed truths. As a result, as
Steve put it, “There are often times many answers to a question. I think you have to put yourself
in many different states of mind and scenarios in order to understand that subject well.” He said
CT involved “trying to analyze all of those scenarios in a way that shows you many different
truths.” With regard to socially constructed truth, the evaluative criteria he used involved the
broadening of perspective and experience. A critical thinker should “come to understand
something in the entirety of its existence,” “try to understand that subject fully,” and “look at it
from many different angles and perspectives.” These elements, he argued, played a huge role in the ability of a critical thinker to trace the cultural paths through which a truth was constructed. I asked him if his notions of multiple truths was an oxymoron or whether it was compatible. He replied, “Well, I think it’s compatible in that, just look at belief systems in different cultures. We are at odds with each other about religions and how the world exists…so there are many truths depending on who is at the table and what we’re talking about.”

Speaking of truth as a product of an individual’s work, he turned esoteric. “Some of my favorite work is naïve work… it is original, it’s true, it has a truth about the person that made it and it has a uniqueness to it as well that stands apart because of that and you can see it, you can sense it, you can…I mean, here is someone who is genuine and whose connection with this creative spirit in expressing a world that she sees.” He argued that CT was involved in this creative process. Hence the standards that he used to judge critical thought did not involve the pursuit of a cognitive or rationalistic path but one that explored things like “genuineness,” “authentic experiences,” “sincerity and things that are more real about a person.” He said of his approach, “I take a holistic view in this situation. Trying to look at it again, not just coldly, but humanistically. I guess kind of getting to the core of somebody, a realness, a genuineness, I guess…which is sometimes hard to do in an analytical kind of way.” The goal of CT was not so much to reach a conclusion or truth but to acquire an extra dimension of consciousness.

As a result, context determined not only the nature of an artist’s work but also the criteria he used to evaluate CT. While as an artist he valued expression of self, he held that his evaluation of work produced by an artist with autism or an untrained artist would differ from what he expected of an undergraduate student. I wondered how he reconciled holding that there were multiple truths and ways of experiencing things and yet using a criteria-based approach to
evaluate CT in undergraduate students. I asked him if he was being inconsistent as without objective standards anything should be acceptable, especially when naïve art is celebrated in his discipline. He explained that it was not a hierarchical gradation but a case of difference. For undergraduate students, he argued, it was important that they ground their work in historical and cultural perspective and in a broad range of personal experience. He pointed out that if he were to “look though another lens or window” those criteria may not apply. Hence for Steve the definition of CT, the outcome of the CT process and the criteria used to assess CT were driven by context.

Roseanne also took a contextual approach to defining the outcome of CT. The goal of a historian she said was not to just communicate; there was a very specific objective - “primarily to tell the truth.” She described the quest for truth as the “obligation that history has that other forms of communication necessarily do not have.” A good critical thinker, in her evaluation, would “make every effort to express and explain the truth and structure so others can access the information we’ve gained.” Her usage of the word truth is different from Paul’s usage in the level of objectivity that was possible or attainable and in the role that perception played in telling the truth.

I asked her to explain whether the nature of the truth she described was objective in that if all of her students witnessed the same event or read the same historical text that they would arrive at the same conclusion or truth. She replied, “That’s never happened.” She reasoned, “My students are not all automatons and there are all sorts of personal factors that enter into it; both good and bad. They are different in how they receive information.” I challenged her on the notion of perceived truth and asked if achieving such truth was possible at all. Recognizing that it was an aspiration, she replied, “I think we are obligated to try. It beats lying.”
When CT is used solely as a means to communicate, she held you can communicate merely to express self or to achieve a meta-narrative. In such cases, “It doesn’t necessarily have to be true except for you emotionally.” Hence, CT in communication involved the process of establishing how one was being true to self. As is evident, truth in both history and linguistic communication originated from the individual. She held that context was determined by “the object of the person writing and his audience.” Therefore the criteria she used to evaluate CT depended on the context.

**Summary of finding 3.**

There is ample evidence to show that faculty in the humanities drew from their personal epistemology to conceptualize CT, evaluate the process of justification and make judgments on the outcome of the CT process. Closely associated with the process of justifying conclusions made as a result of the critical thinking process were faculty assumptions on the world and the nature of knowledge. Intrinsically tied to judgments on the outcomes of CT were notions that faculty held on truth and standards.

Roseanne held to different notions on truth as an outcome of the CT process in different disciplinary contexts. However, her notions of truth can broadly be described as constructivist. Her personal epistemology determined how she saw history as a discipline. As a historian, she argued that she used both historical and literary texts. She referred to it as “multi-sourcing” to answer a historical question. She argued that in her dual disciplinary role, she tended to see historical texts as “artifacts, or expression, but seldom as indigenous to the time and people who produced them.” I interpret this statement to mean that historical records contain events that happened in the past to which individual’s apply perspective. When discussing the ontological assumptions of Roseanne and Steve I pointed to the importance they placed on making
metaphorical connections to the past. Roseanne was among the group of historians who saw history as belonging to the humanities rather than to the social sciences. Hence, the nature of her approach to CT and her judgments of CT are connected with her epistemic stance which leaned toward constructivist notions on truth.

Paul’s approach to CT exemplified a different challenge. His personal stance to truth and standards for evaluation differed from his professed epistemological stance. As pointed out when discussing his disciplinary definition of CT, his approach involved stripping a situation or idea from the context of the thinker and the context in which thinking is done to create a sterile, objective frame work for evaluation. His disciplinary approach together with the structural path to CT did not necessarily engage the personal epistemology of the thinker. As a result, his real personal epistemology was shrouded by the procedural, formulaic, disciplinary method. Personal epistemology was not sufficient to explain his approach. This led me to the finding discussed below.

**Thematic Finding 4: Faculty Approaches to CT - A Response to External Pressure**

The lack of the ability of disciplinary, ontological and epistemological elements to explain some of the differences in Paul’s approach to CT as evidenced in his stated epistemology and what he really believed forced me to take a closer look at the data for alternative explanations. I found overwhelming evidence to show that faculty in the humanities were responding to some form of external pressure when formulating their disciplinary and pedagogical approach to CT and their judgments on critical thought.

Given my prior knowledge of CT in the discipline of philosophy, Paul’s treatment of CT as formal logic, formulaic structures and objective truth did not surprise me. But it intrigued me as it stood out so starkly from other disciplines the humanities. His approach was even more
adherent to rationalistic processes used by faculty in the natural sciences. I asked him what his personal notions on truth were, and for purposes of clarity, I quote his response again: “I myself, I’m not sure I have a worked out view of what truth is. I am attracted to the view of a friend of mine who is a pluralist about truth. He thinks that there can be different notions of truth in different discourses.”

I asked him why he still used and taught CT as formal logic that leads to objective truth despite the limitations of the approach and that his personal views on truth were not aligned with objective truth. He was very candid and pragmatic in the reasons he offered. First, he reasoned, the philosophical ideals of deductively valid arguments had “the merit of being easy to formalize” and was “a convenient idealization to start with.” Second, he said that in philosophy, “currently the ideal in the discipline is that lines of reasoning could be formalized or nearly formalized… that ideal is explicitly espoused by some people and is widely visible in journals.” Third, he pointed to the sociology of CT in philosophy. “This is a dispute that has played out since the late 1800s when formalized logic was introduced as to what extent it is an ideal for philosophy as in the sciences to be able to formalize or mathematize their claims…It is definitely a dominant force today… I have a stack of journals here that if you flip through it would be shocking to not find some formalization in any random text almost like a science journal.”

However, he also said, “In my own opinion a lot of this is gratuitous.” He said that “the vast bulk of what is published does not meet that ideal…most people who fall short of it still think that they ought to be able to formalize their logic.” Distancing himself from the dominant view, he acknowledged, “If you can tell, it’s really not my view but like I said, it was gratuitous.” He acknowledged that he was “a minority in articulating” opposition to the dominant discourse in philosophy. He rued, “why people would espouse it as an ideal when people are not
using it is either a mystery or they don’t really have it as an ideal and they are going along with it. And they’re entitled to keep doing what they’re doing.” Nonetheless, he was clearly influenced by and was responding to pressures from within the larger discipline in how he conceptualized CT and how he taught it in his classroom. He experienced the system in ways that did not promote or validate his knowledge and approaches to CT. It also provided a credible explanation for the discordant themes that emerged from the Paul’s stated epistemology and what he really believed.

Chapter Summary

Summarizing the findings in the humanities posed multiple challenges. The blurred lines between personal definitions of CT and disciplinary definitions and the complex alignment of their personal epistemologies and their responses to external pressure made the analysis difficult. In addition the variability and indeterminacy of culture, language and individuals together with esoteric elements like relevance, meaning and metaphors made the analysis complex. Despite the challenges, I can confidently conclude from this data set that disciplinary approaches, ontological assumptions, personal epistemologies and external pressure influenced the way faculty from the humanities conceptualized CT. As in the natural sciences, I found it difficult to argue whether the nature of disciplinary approaches and methods cultivated and reinforced personal epistemology or vice-versa.

In general, faculty from the humanities accorded to CT a place of importance in their disciplines. They recognized the role that language played in expressing critical thought and the everyday relevance of their disciplinary approaches to CT. It would be fair to say that within disciplinary, educational contexts, faculty tended to focus on aspects of CT that were most relevant to their disciplinary needs. When gauging whether thinking is critical or evaluating the
premises of arguments, the waters got muddier. These faculty relied on their personal epistemologies or external pressure to make such judgments. Their ontological assumptions influenced their understanding on the properties of the term CT thereby also influencing their pedagogy.
Chapter 6

Faculty Approaches to Assessing CT in the Humanities and Natural Sciences

In this chapter, I discuss my findings on how faculty in the humanities and natural sciences conceptually and practically approached the assessment of critical thinking in their classrooms. It draws heavily from faculty conceptualizations of CT as described in the previous two chapters. I have structured this chapter around the following four broad themes that emerged from the data:

- Types of assessment artifacts used to assess for CT
- Instruments used to assess or measure CT
- Nature of assessment artifacts developed by faculty to assess for CT
- Connection of faculty with institutional assessment methods

Finding 1: When Assessing for CT, Faculty Used Types of Assessment Best Suited to Disciplinary Content and Context

Faculty mostly preferred to use pieces of writing of significant size to evaluate for critical thinking in students. The representation in Table 1 shows the type of artifacts that faculty used to assess for CT in their disciplinary courses. A closer look at these lists revealed that faculty used an array of artifacts ranging from simple multiple choice tests and quizzes to more elaborate approaches like collaboratively developed assignments, drawing, portfolios and displays of work where students were asked to share their thinking processes and reasoning.
Table 1

*Type of artifacts preferred by faculty to assess for CT*

<table>
<thead>
<tr>
<th>Natural sciences.</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chemistry</strong></td>
<td><strong>Physics</strong></td>
<td><strong>Botany/Biology</strong></td>
</tr>
<tr>
<td>Analysis of published research</td>
<td>Analysis of published research</td>
<td>Analysis of published research</td>
</tr>
<tr>
<td>Observation of students</td>
<td>Capstone project</td>
<td>Multiple choice tests</td>
</tr>
<tr>
<td>Multiple choice tests</td>
<td></td>
<td>Drawing</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Humanities.</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Philosophy/Ethics</strong></td>
<td><strong>Romance Languages</strong></td>
<td><strong>Studio Arts/Graphic Design</strong></td>
</tr>
<tr>
<td>Quizzes</td>
<td>Essay exams</td>
<td>Presentations</td>
</tr>
<tr>
<td>Exams</td>
<td>Collaboratively designed writing assignments</td>
<td>Pieces of writing</td>
</tr>
<tr>
<td>Writing</td>
<td></td>
<td>Talk about the work</td>
</tr>
<tr>
<td>Observation of thinking processes</td>
<td></td>
<td>Hear them and listen and respond</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Watch them create</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Work with them</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Combination of craft and concept</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Art shows of the final work</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Portfolios</td>
</tr>
</tbody>
</table>

What also became evident was that faculty sought to assess for CT in assignments that were relevant to their disciplinary content and context. Faculty from biology, chemistry and physics developed artifacts that would have students evaluate knowledge claims using empirical and mathematical means. The botanist thought that drawing a concept from a particular perspective could help with assessing CT. Faculty from philosophy preferred the use of artifacts like quizzes and multiple choice tests that tested for skill and mastery of a process. Faculty from romance languages, studio arts and design preferred artifacts like portfolios or essays that were situated in context and gave students an opportunity to discuss their work and make their thinking more evident.
I found that most faculty did not use a single artifact or end product to assess for CT. They used a combination of formative and summative forms of assessment and combined them with observation, listening to, and challenging students’ thought processes. This was truer in the humanities than in the natural sciences. Faculty from chemistry, physics and philosophy were more comfortable with identifying specific summative artifacts for the assessment of CT. Faculty from biology, romance languages, studio arts and design identified formative artifacts that involved drawing, essays, craft, and portfolios as artifacts with which they associated elaborate developmental processes. They described processes such as discussion, negotiation, dialogue, observation, hearing and listening for meaning. The nature of the assignments they identified involved a process that led to the final product. They argued that the end product by itself was not sufficient to communicate the depth of the critical thought that went into the creation of these artifacts.

For these faculty, CT was expressed as a complex, developmental process rather than an artifact. In their opinion, a fair assessment of CT needed to consider the effort that went into decision making, the process of idea generation, ideas that emerged during the process of making a piece of craft or art, self correction, and responses to feedback. Steve said, “I can hear them and listen to them and, um, I guess respond to them, too, and know if they’re growing.” Each of these stages, he argued, contained elements of CT. As a result, CT was more assessable in their disciplines during the developmental process than in the final product. They used rich imagery to capture that process. Roseanne from romance languages said, “I don’t want a mirror. I want their movie, but they actually have to direct and write that movie for me to have it.” Steve from studio arts described CT as represented in assignments as a process that “bakes and grows.” He said, of
a craft portfolio as an end product, “We're looking at their portfolio at the end. And so I wouldn't
be able to assess CT necessarily at that point in time.”

Formal assessment approaches used by general education programs and standardized
tests focus primarily on summative means to assess for CT. As is evident from the above
analysis, summative forms of assessment do not lend themselves to the assessment approaches of
faculty in all disciplines. This finding also highlights the importance for university assessment
officials to use artifacts that provide scope for a student to make their thinking visible. A student
may be thinking critically, but if the form of assessment only assesses the outcome of thinking
and does not allow for a student to make their thinking process visible, an evaluator can run the
risk of misjudging critical thinking ability of students in some disciplines. It also emphasizes the
need to diversify the type of artifacts used in the assessment of CT in general education to be
reflective of the methods and aspirations of multiple disciplines.

Finding 2: Faculty Rejected the use of Multiple Choice Tests as a Valid Measure of CT

Though I did not specifically ask a question about the use of multiple choice questions to
assess for CT, most faculty brought it up in their interviews with a lot of passion. Faculty who
held to more rationalistic, formulaic conceptualizations of CT appeared more inclined to tolerate
its use in disciplines like chemistry, physics, philosophy and biology. However they all
highlighted the limitations of multiple choice tests and Scantron bubbles to assess for CT. Paul
from philosophy held, “Oftentimes we end up doing quizzes and exams, and things like that are
not as good at getting at the core skills…but they could capture whether you had the right truth at
the end.” Brenda from biology spoke of her experience using multiple choice and Scantron
bubbles when she said, “They might not always show you what you want…I don't think it's
assessing what they really know.” Charles admitted he used multiple choice tests but rued,
“Yeah, I don’t know if multiple choice is good for critical thinking.”

The scathing rejection of multiple choice and Scantron bubble-type tests, however, came
from the humanities. Roseanne from romance languages argued, “Perhaps the vilest
quantification I can imagine is the infamous, multiple choice exams. Fill in the blank or, uh, you
know, block in the number or fill in the box with, back and forth, back and forth. I don’t think
that that's a valid measure.” The professor of philosophy argued, “I guess multiple choice tests
couldn’t capture the richness of the critical thinking process…but they are a hell of a lot better
than Scantron bubble sheets for getting at core skills.”

Given that faculty across disciplines rejected or acknowledged the ineffectiveness of
multiple choice tests as a valid measure of CT, the use of such tests at the institutional or national
level raises serious questions for the validity of such measures. In addition, such assessment
methods do not reflect how faculty assess for CT in the classroom. Without establishing the
validity that faculty seeks in assessment measures, any form of institutional assessment rarely
garners the confidence of faculty or their buy-in. This finding highlights the meaninglessness of
using standardized, multiple choice assessments as an indicator of CT in undergraduate students.
It repudiates the validity of inferences and conclusions drawn based on these tests about student
ability or faculty and institutional efforts to develop critical thinking students.

**Finding 3: Faculty Did Not Explicitly Assess or Measure CT in Students**

Interestingly, faculty in this study did not use or develop any instrument to assess for CT
explicitly within student artifacts. When I asked to see rubrics or instruments that they used to
assess CT, their responses are captured well in their own words:
Mark: So do you use any instruments like rubrics or anything to assess for critical thinking in your courses?

Chemistry: “No. Well, not at the undergraduate level.”

Philosophy: “No, we have no formal rubric, it depends on the student.”

Physics: “We know it when we see it.”

Studio Arts: “I can show you one that the director of assessment gave me. It’s in a file somewhere.”

Biology: “I think my TAs use a rubric.”

Romance languages: “No, I don’t use one.”

As is evident, none of the faculty who participated in this study was able to produce rubrics or any assessment instrument used to explicitly assess for CT in classroom assignments. As a result, faculty do not have a way of knowing whether students have progressed as critical thinkers in their courses. The professor from chemistry epitomized this response:

Mark: But then you have no way to assess for CT in your classroom, right?

Chemistry: Right.

Mark: You don't know whether you're being effective on that count.

Chemistry: Oh, heavens no. I have no idea whatsoever. You know...

This finding ties in well with what I called the “hopeful” pedagogy in chapters four and five when discussing faculty conceptualizations of CT. The above comments lead logically to the question, how do faculty assess for CT?
Finding 4: Faculty Carried their Disciplinary Conceptualization of CT Implicitly into the Type of Assignments Used to Assess for CT

The finding that faculty do not use formal assessment measures like rubrics to assess for CT must not be construed that faculty do not assess for CT. During the interviews, my attempt to interpret their lack of formal assessment approaches as a lack of assessment of CT was met with stiff resistance. For instance, I asked Paul from philosophy if it would be fair to say that he used an “I know it when I see it approach” to assessing CT. He retorted, “Well, I would say mostly yes to that, with a reminder that we are regularly teaching them specific notions of validity and soundness and so when we know it when we see it, it’s not porn.” He continued, “We’re looking for good reasoning and we’re looking for them to engage in these reasons of validity and soundness.” Philip from physics argued, “Do we have implicit rubrics in our head? I think we do. Do we ever write them down? No.” These responses were typical of participants in all disciplines. They all claimed to assess for CT but implicitly using core skills and learning outcomes that are woven into their disciplinary content. An analysis of some assignment prompts that faculty used in their disciplinary courses will help strengthen this finding.
Samples of assignment prompts used in the humanities.

<table>
<thead>
<tr>
<th>Course: French Literature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freedom, opportunity, the future. Trace the parallel development of these hopes in events, ideas and personalities in the French Revolution and the Caribbean slave revolts. Did either or both succeed, explain.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course: Spanish Civilization</th>
</tr>
</thead>
<tbody>
<tr>
<td>What elements (religious, political, social, economic) made the Spanish Habsburg empire a surprise? Given those elements, was the empire actually inevitable in light of late medieval European state growth? Explain.</td>
</tr>
</tbody>
</table>

*Figure 1. Sample assignment prompts used in romance languages.*
Is the following argument valid and sound? Explain your answers.

Premise 1: If the moon is made of cheese then it is made of a dairy product.
Premise 2: The moon is not made of a dairy product.
Conclusion: Therefore, the moon is not made of cheese.

Analyze the following argument in terms of validity only.

Premise 1: If a widget is blue then it is square.
Premise 2: Widget W is not square.
Premise 3: Widget W is not circular.
Conclusion: Widget W is not blue.

Descartes says such and such. Evaluate what Descartes said, explain and evaluate his reasoning and arguments in terms of validity and soundness.

Is abortion right or wrong? Objectively evaluate whether the reasons provided by both pro-life and pro-choice stances are good reasons for their conclusion whether you agree with them or not.

I will undertake a closer examination and comparison of the artifacts from the humanities. In general, assignments in the humanities were heavily situated in perspective and used the language of words to explain and establish meaning, thereby providing the vehicle for the expression of critical thought. In addition, these faculty carried their conceptualizations of
CT into the development of their assignments. However, there are disciplinary distinctions to be marked within the humanities.

The assignments in philosophy (Figure 2) sought to formalize the rules of logic where sound premises lead to logical conclusions or truth. They also clearly provided students with the criteria for the judgment of ideas — rationality, validity and soundness. They contained arguments or positionality for certain views that needed to be evaluated and reasoned using formal logic. As a result, quizzes were the dominant means of assessing for CT in philosophy. This assessment approach is in line with the procedural, formulaic and logical conceptualization used for instruction of CT in philosophy.

The assignments in ethics provided nuanced differences from philosophy. They required the evaluation of two competing views on abortion with equally valid arguments or logical merit. CT was assessed as the ability to see the arguments on both sides and possibly conclude that there was no definitive evidence to take a stand on the issue. Even within sub-disciplines of philosophy, there emerged disciplinary differences in approach to CT. While assignments from philosophy focused on a procedure-oriented, formulaic approach to arrive at definitive truth, the assignment from ethics sought perspective, and recognized the existence of two sides and the presence of valid arguments on both sides of the abortion debate. Nonetheless, they both are similar in that they used rationality as the basis for CT and are based on the ontological assumption that CT involves formal logic and rationalistic processes.

The assignment from romance languages sought an explanation of thoughts and perspective on literary and historical texts. Interestingly, as with her conceptualization of CT, the contrast between Roseanne the historian and Roseanne the language expert becomes evident. As a historian, her assignments are concerned with the examination of actual events requiring a
substantiated defense for the position taken by the student. The goal of the history assignments was to stay true to what actually happened in the past or to the closest possible approximation of an event. As a language expert, she argued that students needed to use both historical and literary texts to mark their answers. She referred to it as “multi-sourcing” to answer a historical question. She argued that in her dual disciplinary role, she tended to see historical texts as “artifacts, or expression, but seldom as indigenous to the time and people who produced them.” Clearly, Roseanne was among the group of historians who saw history as belonging to the humanities rather than to the social sciences. Hence, the nature of her assignments and her expectations for the assignments emerged from that epistemic, disciplinary stance.

The assignments from literature and studio arts focused on the individual narrative, sought to establish contextual meaning and recognized genre. Steve from studio arts captured this approach well when he argued, “Everyone has a kind of a bent, visually - a visual kind of bent that relates to some aspect of the field. Maybe it's a traditional format, maybe it’s very avant-garde. Maybe it’s just working with stones and gold or, you know, whatever. And so based on their particular interests, I would guide them and offer them suggestions or ideas to get them started.” Faculty from languages, studio arts and design said they looked for the application of ideas, depth of analysis and breadth of research. They wanted their students to reach dialogic conclusions or an expression of or the resolution of ideas. Faculty approaches to assessing for CT show strong links to their disciplinary conceptualizations of CT.
Samples of assignment prompts used in natural sciences.

**Course: Introduction to Biology**

Read the following published article and write an essay using the following questions:

1. What problem or question is the author trying to address?
2. Does the author state the problem clearly?
3. What is the author’s hypothesis in the article?
4. Does the author make a sound argument in which the facts logically support his position?

**Course: Introduction to Botany**

If you were to look on the earth, what would it look like if you're an ant? Draw your ideas from an ant's perspective. Contrast an ant's perspective to the perspective of a man on the moon.

*Figure 3. Sample assignment prompts used in biology.*

**Course: Organic Chemistry**

Molecules interact with other molecules and affect the very physical properties of those molecules. Use this information to predict how a mixture of these two materials might interact - ethanol and CH$_3$MgBr.

**Course: General Chemistry**

Design an experiment to test the following hypothesis:

*Figure 4. Sample assignment prompts used in chemistry.*

Faculty in the natural sciences generally focused on assignments that involved problem solving, scientific reasoning, synthesis of ideas and the testing of causal hypotheses. Charles who conceptualized CT as a skill that involved synthesis of information, said, “I'd like to include
questions that I call essentially synthesis questions where they have to take independent facts and come up with another hypothesis.” Brenda from biology, who conceptualized CT as problem solving and decision making, said she used the following criteria: “Can they state the hypothesis? Did they come to a logical conclusion? The conclusion may be different, but is it logical based on the knowledge that they have?” What emerges is a connection between how these faculty conceptualized CT and the purpose and content of assignments they used to assess for CT.

I found it very interesting that while some faculty from the natural sciences used a rationalistic approach which focused on objective truth to conceptualize CT, when seeking to assess for CT through assignments, some of them sought perspective. Charles from chemistry argued, “But to get a true assessment, you really kind of need to also give them a chance to actually be able to research the facts and things and fill the hole in the knowledge they don’t have.” The coming together of the definitive nature of knowledge and the tentative nature of knowing that emerged from their conceptualization of CT found its way into their assignments to assess for CT. I asked them how they aligned the two seeming contrasting views. At this stage they pointed to the tentative nature of knowing in their own disciplines. They argued that their approach to assessing for CT involved not choosing an option or perspective but “proving” that it is the accurate option. The process of proving something beyond reasonable doubt involved CT. Hence, most of the assignments in the natural sciences focused on assessing for the ability of students to evaluate knowledge as represented in published research articles and to examine the logic, reasoning and conclusions presented by an author using logical reasoning and mathematical validity as evaluative criteria.
Considering the assessment prompts and approaches used by faculty in the humanities and natural sciences to assess for CT, there is strong evidence to show that they developed assignments to assess for CT using their disciplinary conceptualizations of the term. The skill sets that each of these faculty identified and assessed for are robustly discipline-based with sufficient nuance even within sub disciplines in a field of study. This finding raises serious questions on the efficacy of approaches that use questions or assignments that are devoid of context or set within contexts that are alien to some disciplines, or assess for a standard set of discipline-general CT skills in all students irrespective of discipline. CT when applied to real life situations or disciplinary contexts is not understood by faculty as a procedural set of steps or standardized skills. They see CT as a rich conglomeration of approaches that cannot be captured or assessed by a single discipline-general standardized test or rubric.

Finding 5: Faculty Assessed for CT as Integrated with Other Learning Outcomes

As was found when examining faculty conceptualizations of CT, I found that faculty saw CT as integrated with other learning outcomes at the time of assessment. This finding is accentuated even more within their assessment of CT. For CT to be evident in student work, it required forms of expression like writing, oral presentations, drawing, craft or art. Paul from philosophy argued, “Students do pretty well at reasoning and not pretty good at talking about what’s working in their reasoning and, of course, that makes them bad at extending those skills to other areas.” He continued, “What we are looking for when we talk about critical thinking skills is the ability to comprehend, articulate, analyze, and then, of course, for yourself produce this kind of premise-conclusion argument.” Faculty from physics and romance languages argued that the expression of critical thought is intrinsically tied with a student’s ability to comprehend,
articulate and communicate using a medium of communication and within the preferred language of expression (numbers or words) for critical thought in their disciplines.

These faculty held that it is difficult to delineate learning outcomes in practice as can be done theoretically. Philip from physics argued, “We never look at just critical thinking in isolation. We're also looking whether they gained skills.” The integration of learning outcomes was so important that they argued that critical thinking, when not adequately communicated, cannot be assessed. Roseanne from romance languages said, “There are individuals who are capable obviously of great critical thinking, but they cannot readily offer it up to other people.”

At the same time, faculty held that other learning outcomes like writing or oral communication were enhanced through the use of CT. She captured this connection well when she said, “Communication is worthless unless you assess a certain value to it because all of it is not equal. All of it is not the same.” The presence of CT in disciplinary artifacts enhanced the value of an artifact and the value of other learning outcomes.

Finding 6: Faculty had Little Awareness of Institutional Approaches to Assess CT in General Education Programs

I conducted a brief survey with participants on their awareness of CT assessment on their campus. I found that faculty were disconnected at several levels. All of the participants said that their departments did not have an operational conceptualization of CT. As pointed out in Chapter 3, both universities at which this study was conducted used specific conceptualizations of CT in their general education programs. All faculty participants responded that they did not know if an operational conceptualization existed at the college or university level.

Also evident is a disconnect of faculty from the mission and formal assessment practices of the general education program. Professors from disciplines like philosophy and biology
argued that individual professors cannot take credit for the development of CT skills in students nor can they be blamed for the lack of it in students. The difficulty of placing responsibility for the development of CT as an outcome of general education is difficult as responsibility does not rest with a single faculty member, department or college. The general education program transcends specific courses, departments and colleges, making the assessment process and paths for accountability more complex. In addition, faculty pointed out that the tenure of an academic quarter or semester makes it difficult for specific faculty to adequately focus on the development of CT in students. Faculty in the natural sciences rued that they needed to focus on memorization and learning of disciplinary content and by the time they were ready to focus on teaching for CT, the term of the semester had expired. A few faculty complained of time constraints and large class sizes for lack of focus on CT. In addition, all of them admitted that they had not been formally trained to teach or assess for CT as an outcome in their courses nor did they know the role they or their courses played in the larger general education program. However, some participants were aware that there was a general education rubric that was developed at the university level.

I also found that faculty were disconnected from their own approaches for assessing for CT when called upon to explicitly assess for CT. Even though faculty from different disciplines developed elaborate assignments and processes to assess for CT through their disciplinary assignments, when I inquired about how they would assess for CT explicitly if they had an opportunity to do so, they said that they would use the general education rubric developed by the university. Philip from physics said, “I’d use a rubric that I based off of the gen ed one.” The following exchange with Steve from studio arts shows the danger of the unquestioned use of existing rubrics by faculty to formally assess for CT.
Mark: So if I were a university officially charged with assessing critical thinking
development in students, and I came up, and I said, Steve, you need to help me assess
critical thinking for your department or your program, what would you do?

Steve: I would go over here to my assessment book, and we've actually been working on
this.

We both discovered while looking at the rubric in his file that the components he
attributed to CT were not contained in the rubric. I asked him about the disconnect in his
classroom approach and formal assessment approach in this exchange:

Mark: Would you say you're kind of doing a disservice there, this rubric assesses just the
conceptual. You’re relegating CT to a purely cognitive skill, whereas we’ve spoken about
this richness of critical thinking in your discipline that’s beyond cognition. But yet when
you assess, you’ve resorted to a more rationalistic kind of approach.

Steve: Well I think you would find if you were in attendance at these things that, um, …
that, um, you know, the discussions are pretty candid and, um, you know, our hand is
forced really to have to make descriptions on scenarios of people. And critical thinking, I
see that as something that happens when they’re in the classroom working with the
instructor. Where ideas are emerging and developing. I don’t think we’re looking at the
beginning of where the critical thinking ability is.

The disconnect that he and his colleagues faced in conforming to formal discipline-
general assessment of CT is borne out in the words “our hand is forced really to make
descriptions on scenarios of people.” His formal assessment approach looked for aspects of CT
that he criticized as meaningless and was seeking to assess for CT at a stage in the development
of the assignment when it was least evident.
Both universities from which data was collected in this study used discipline-general rubrics and summative forms of assessment to assess CT in general education. What is more disturbing is that faculty did not question why they needed to use the general education rubric or how it reflected their discipline or classroom approaches. As I pointed out in the literature review, with regard to standardized tests there is a need for rubrics and tests to come with conceptualizations of CT and the intent and purpose for which such instruments were developed. Labels like “Critical Thinking Rubric” lulls even questioning disciplinary experts into believing the instrument can assess for CT in their disciplinary contexts. As Hutchings (2011) warned, when assessment is treated as a bureaucratic task, undertaken to satisfy external requirements, such efforts will have little impact in the classroom.

This finding revealed a disconnect between how faculty assessed for CT in courses and how they respond when called upon to formally assess for CT. It throws light on why faculty approaches to assess for CT in the classroom have no correlation with discipline-general or standardized assessment approaches. It may also hold leads to explaining reasons for faculty disconnect from institutional approaches. If faculty knowledge of their own conception of CT or their assessment approaches holds no weight, and is ignored or disrespected, then is it possible that the faculty lose hold of what they know about CT? Does that contributes to their silence or disconnect from their own knowledge about CT and also from institutional approaches?

Chapter Summary

This discussion showed that there is evidence that faculty assess for CT implicitly through disciplinary content using disciplinary artifacts and elements of CT that were meaningful to their specific discipline or sub discipline. Faculty in general carried their disciplinary conceptualizations of CT to the type and nature of artifacts that they used to assess for CT. They,
however, did not use formal rubrics to explicitly assess for CT, but assessed for it implicitly through criteria and forms of communication that were closely tied to their discipline and personal epistemology. It would be fair to say that faculty take a robustly disciplinary approach to assessing for CT and look for skills that form part of their disciplinary conceptualization of CT.

The advantages of taking an exploratory approach to studying faculty approaches to assessing for CT are experienced in this chapter. It has provided insights into the world of faculty that can help with aligning institutional approaches to assessing CT and has helped raise questions on the dominant discipline-general approach to conceptualizing and assessing for CT. Therefore attempts to assess for discipline-general CT in students using any form of assessment renders such assessment models and its outcomes meaningless; given that faculty in general education courses did not focus on teaching or assessing for discipline-general CT. This chapter highlights a misalignment of faculty assessment approaches with discipline-general approaches used at the institutional level and even by standardized tests used for accountability purposes at the national level. It also highlights the need for complex and multiple assessment approaches to assessing for CT rather than a standardized or discipline-general approach.
Chapter 7

Faculty Conceptualizations of CT in the Natural Sciences and Humanities - Findings

My Analytic Journey Using Grounded Theory

The question that started this dissertation journey ended up being more complex than I had anticipated and I am happy it did. An integral requirement to reach findings using grounded theory was selective coding (Glaser, 1998). Glaser held that this process involved aligning axial codes so that they all fit well around a core code. Given that my positionality was vested in a disciplinary stance, I first used disciplinary clusters as a selective code. While I found strong evidence that faculty used a disciplinary approach to conceptualize CT, I also found it difficult to align codes solely based on discipline clusters because of discrepant data. For instance, the biologist and botanist identified their discipline as aligning more closely with quantitative approaches but the behavioral nature of living organisms made their approaches to CT different and more complex. They stood apart from their colleagues in chemistry and physics in their approach to CT. In the humanities, philosophy stood in contrast with history, romance languages and studio arts. Data from philosophy could have been seamlessly incorporated into the natural sciences cluster. Given the outliers that emerged when using disciplinary clusters to categorize data, it was difficult to conclude that disciplinary leanings alone could adequately explain how faculty conceptualized CT. Hence, the methodology forced me to seek alternative explanations.

I worked for weeks rearranging codes and searching for alternative explanations. I found another way of classifying conceptualizations of critical thinking used in the natural sciences and the humanities. The “language,” as the participants put it, used to express critical thought in their disciplines figured in all of the approaches to CT. Philip from physics said, “In science,
mathematics is the equivalent of our language…You need to know how to manipulate this language of mathematics.” Charles held, “A large portion of the undergraduate education is learning to use the language and to apply it, to know when to use it, to know when to use the right kind of skills.” Roseanne argued, “If you have a great idea and you cannot express it in any language, either human or social or numerical, you have a problem.” The language of critical thought had close ties with the research methodology that faculty used in their disciplines. While some faculty used the language of numbers and quantitative methodologies, others talked about the language of words, meanings, contexts and qualitative approaches.

It then occurred to me that the “language” through which critical thought is expressed was based on underlying epistemological assumptions. After researching the literature on personal epistemology, I was convinced that I had to explore faculty approaches to CT based on their personal epistemology. I found that even though faculty toed disciplinary lines when defining CT, their views on the outcome of the critical thinking process or how they made judgments on what was CT or whether an individual displayed critical thinking was heavily influenced by their personal epistemologies. I will discuss this finding in detail later in this chapter.

However, Paul from philosophy posed problems when using personal epistemology to align the axial codes. As pointed out in chapter five, he felt pressure to “gratuitously” align with the formulaic, quantitative trends in his discipline; thereby, masking his personal epistemology. His definition of CT, pedagogical approach and stated epistemology were at odds with what he personally believed about truth and objectivity. As a result, within the humanities, I explored the role that external or systemic pressure played in how faculty conceptualized CT.
Out of the data from individual interviews and focus group discussions emerged assumptions that faculty held on the nature of CT. These assumptions formed a good means to compare and contrast disciplinary approaches to CT within and across disciplinary clusters. Hence, I also categorized the ontological assumptions that faculty held of CT as a selective code.

Therefore, the answer to the question, “How do faculty conceptualize CT?” did not have one answer. It required a multi-pronged approach which involved examining disciplinary influences, assumptions held on the ontology of CT, tacitly held personal epistemologies and appreciating the pressure that some faculty faced in toeing systemic or disciplinary pressure. This chapter is structured around the above analytic themes that emerged from the data.

**How do Faculty in the Natural Sciences and Humanities Conceptualize CT?**

**Finding 1: Faculty viewed CT as tied to disciplinary thinking, content and methods.**

The preponderance of evidence presented in chapters four and five showed that faculty focused on elements of CT that were applicable to their specific disciplinary contexts. In this section I will broadly compare and contrast the elements of CT on which faculty focused. In addition, I will present findings of faculty perceptions of CT in disciplines other than their own. This approach will provide evidence from multiple vantage points to emphasize the strong disciplinary stance that faculty adopted toward CT.
Table 2

**Key Elements of CT focused on in different disciplines**

<table>
<thead>
<tr>
<th>Natural Sciences</th>
<th>Humanities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem solving</td>
<td>Formal logic</td>
</tr>
<tr>
<td>Decision making</td>
<td>Maintaining validity and soundness</td>
</tr>
<tr>
<td>Rational thinking</td>
<td>Examining multiple perspectives</td>
</tr>
<tr>
<td>Synthesis of information</td>
<td>Exploring the past</td>
</tr>
<tr>
<td>Logical thinking</td>
<td>Qualifying or seeing difference</td>
</tr>
<tr>
<td>Making reasonable assumptions</td>
<td>Seeing nuances of opinion</td>
</tr>
<tr>
<td>Testing hypotheses</td>
<td>Marking distinctions</td>
</tr>
<tr>
<td></td>
<td>Asking questions</td>
</tr>
<tr>
<td></td>
<td>Wondering</td>
</tr>
</tbody>
</table>

In Table 2, I have extracted the important skills that faculty used to teach CT in the humanities and natural sciences. An analysis of the disciplinary definitions of CT and the components of CT listed in Table 2 revealed that faculty focused on different sets of skills. Faculty in the natural sciences broadly conceptualized CT as involving the acquisition of the skills of logic and mathematical reasoning and the application of those skills to solve problems, synthesize knowledge or make reasonable assumptions. Pedagogically, they focused on problems and tasks in the science curriculum and research literature. They implicitly focused on the rationalistic skills associated with CT through disciplinary content.

Faculty from the humanities largely focused on aporetic elements of CT. Irrespective of their opinion on where questions should lead students, they were unanimous that questioning and skepticism were part of critical thinking. Common themes that emerged from the humanities
were that CT involved breaking ideas, concepts, arguments and problems into their components, asking questions, playing the devil’s advocate, weighing context, making distinctions, and classifying information. With the exception of philosophy, faculty from the humanities sought multiple perspectives, broadening personal experiences and the ability to see and appreciate difference as essential qualities of CT.

While it was possible to broadly categorize elements of CT based on the family of skills that faculty focused on in different discipline clusters, a closer analysis of usage of the term within each discipline in the natural sciences and humanities showed that faculty generally defined critical thinking using characteristics, traits or skills that are most applicable to their disciplinary needs. Hence the skills focused on in physics differed even from those that the chemist thought were important for CT. This showed that in their disciplinary approach to CT, faculty focused on subsets of CT that were applicable to their specific disciplines.

While faculty views on CT within their discipline were based on their disciplinary needs and methods, an analysis of their perceptions of CT in disciplines other than their own further strengthened the finding that they saw CT through disciplinary lenses. This is an interesting line of analysis to pursue because, first, it throws more light on how faculty conceptualize CT and second, it reveals disciplinary differences both within natural science and humanities disciplines and between the disciplinary clusters. In addition, it is common practice for university assessment personnel to use a multidisciplinary panel of faculty to assess student artifacts while assessing CT in general education programs. In my professional experience, I have found that it is not uncommon for a professor in chemistry to evaluate a student artifact drawn from a course in English as part of general education assessment. Therefore, I will examine the disciplinary
differences that faculty identified among other disciplines and within sub disciplines in their own field.

Faculty in the natural sciences held strong opinions on what CT looked like in disciplines other than their own. Charles and Philip tended to see more similarities among their disciplines. They chose to mark a distinction between their physics and chemistry with biology. Philip thought that physics and chemistry spend time describing the structures of the real world in purely mathematical terms. They both argued that the biological sciences implemented CT in ways that were different because their data sets were different. Philip argued that the biological sciences have “gone for years without being forced to describe the empirical side of their science through mathematics.” Interestingly, Brenda constantly reminded me that biological sciences were more aligned with chemistry and physics when it came to CT and that findings in botany were expressed using “empirical, mathematical means.” They all held that their disciplines were based on “scientific empiricism” but they all argued that the skills of CT might very well be implemented differently in their disciplines.

Without any prompting, the farthest distance that faculty in the natural sciences sought to establish was from disciplines in the humanities. All of them argued that CT was more subjective in the humanities. Philip argued, “Critical thinking in the humanities, and, you know, criticism of literature...that’s a different process.” He argued that empiricism was not the underlying structure of disciplines in the humanities. Charles held that the humanities were subjective as they were “lost in shades of gray.”

When analyzing their approaches to CT, faculty in the humanities (with the exception of studio arts) sought least distance from the natural sciences or mathematics. Philosophy stood out in the humanities in its affiliation with mathematical logical structures and procedures. Speaking
about philosophy, Paul argued that the formulaic, logical processes that he adopted were more
aligned with “certain parts of computer science and mathematics.” Roseanne at different times
argued that her quest for truth as a historian was no different from mathematics. She described
the differences in approach to CT between the natural sciences and humanities as “artificial
distinctions.” These aspects of their understanding were discussed in detail in chapter five where
I analyzed how these notions were the result of pressure that faculty felt to model their approach
with the natural sciences.

Within the humanities, I found that faculty sought to mark differences among sub
disciplines within their own discipline. Marking distinctions among sub disciplines in
philosophy, Paul remarked, “It should be said that, there are lots of subparts of philosophy and
its various parts are more or less affected by formalizing or mathematizing reasoning, but the
core areas of philosophy and various secondary areas like philosophy of mind, philosophy of
science; those are very much inflected by the mathematization or formalization logic. It’s less
evident in ethics or aesthetics but only somewhat less.” Paul made distinctions between
approaches to CT in philosophy and ethics or aesthetics. He said that in philosophy, CT was seen
as a formulaic, procedural skill and the use of competition as to who could arrive at truth first
was a good means to assess for CT. On the contrary, he wondered whether the same method
could be used by an ethicist and questioned whether there was a universal method to assess for
CT that would be applicable to the philosopher and ethicist. This showed the distinctions that
faculty saw even within sub disciplines within a discipline. It also showed that the rules of
engagement were different and that it was difficult to use uniform methods as a valid measure of
CT across disciplines.
When I asked Steve how his approach to CT and jewelry making compared with those used in a science like metallurgy, he said, “I’m not a chemist, but, um, I would imagine that we, um, utilize knowledge and apply it in other ways.” When comparing his approach with subdisciplines in fine arts, he said, “I think you would get a whole different response from art historians in terms of critical thinking…for instance, the nature of art history is different. I think so much of their work is really academically aligned and I think the studios may be more experiential. I think that’s kind of a big difference between the two. And I don’t know how that would be in the sciences.” Steve did not seem particularly interested to align his approach with the sciences or academically-driven disciplines. His discipline and craft were part of his person and he appeared content to follow his heart.

Roseanne in many ways epitomized the influence that disciplinary content and methods have on an individual’s conceptualization and approach to CT. In her dual disciplinary capacity she applied CT and focused on separate skills and dispositions depending on the disciplinary context. She also held different standards for evaluating CT in different contexts. As a historian she spoke extensively of truth and the quest to prove things like mathematicians and natural scientists. As a linguist, she held that CT was involved in communication and expression of self. She dexterously moved between approaches to CT while maintaining disciplinary distinctions.

The above discussion together with the findings discussed in chapters four and five present overwhelming evidence that faculty in the natural sciences and humanities approached CT from their disciplinary stance and focused on aspects of CT that were applicable to their needs. Pedagogically, too, they were most concerned with skills that would make students successful in their discipline. They all saw CT as an integral part of that process.
Thematic Finding 2: Faculty assumptions on the ontology of CT influenced conceptualizations of CT and classroom practice.

In chapters four and five I have established the “ontological commitments” (Slotta & Chi, 2006) that faculty held on CT. These ontological assumptions showed their understanding of CT and provided interesting insights into how faculty constructed the fundamental properties of CT in their disciplines. Studying the ontological assumptions that faculty held on CT is important for three reasons. First, I found a strong association between the ontological assumptions that faculty held on CT and their stated pedagogical approaches. Second, I found considerable unanimity in ontological assumptions among faculty within a discipline cluster. There was considerable triangulation among participants in the individual interviews and focus group discussions. Third, it provided scope for cross-disciplinary analysis and comparison. For these reasons, an examination of faculty conceptualizations of CT based on ontological commitment formed a meaningful way to categorize findings.

Faculty from natural science disciplines unanimously emphasized the importance of disciplinary content as the basis for CT. In fact they argued that it was impossible to be a critical thinker in their disciplines without a sufficient knowledge base. Charles from Chemistry argued, “If you want to critically think about chemistry, you have to know something about it.” Since the application of CT in the humanities involved everyday life, faculty in the humanities focused more heavily on the acquisition of broader skills that could be applied to multiple bodies of knowledge and situations. They argued that content in their disciplines was not static and, hence, critical thinking in their disciplines involved being able to acquire a set of skills that could help students navigate the multiple and changing realities of their worlds. For instance, the designer in the group discussion held that his students used different software to develop graphic designs.
When evaluating software, it was more important that students knew what to look for rather than knowing the specific features of specific software. Hence for faculty in the humanities, their focus was not on the memorization of content but the acquisition of broader skills and dispositional capabilities.

Differences in ontologies also emerged when analyzing the elements that faculty focused on with regard to CT. Faculty in the natural sciences focused heavily on the acquisition of rationalistic skills of logic, analysis and reasoning and the application of those skills to disciplinary content. They all held that the skills of CT were contextualized within the parameters of mathematical and statistical validity. Faculty in the humanities focused more heavily on aporetic elements of CT. They used phrases like “interrogative but cautious,” “the habit of curiosity,” and “develop their own filters” to describe critical thinkers. They identified language and words as the primary means of communicating critical thought in their disciplines. Acknowledging in varying degree the role that logical rationalistic elements of CT played in their disciplines, faculty in the humanities held that broadening of perspective and experiences was vital to thinking critically.

However, I found two areas of considerable overlap among faculty in both disciplinary clusters. The first was that faculty saw CT as being dependent on context. The second was that they viewed CT as integrated with disciplinary content and other learning outcomes. These assumptions require attention considering the broad unanimity that existed across disciplinary clusters, and the fact that these themes also emerged in faculty approaches to assessing for CT discussed in chapter six. Therefore, I will focus on these assumptions because of their importance in speaking to the issues that this dissertation addresses.
CT is dependent on context.

Faculty in the natural sciences and humanities expressed keen awareness that CT was determined by context. I found that while faculty in the natural sciences were keen to associate with the scientific mathematical model, they all admitted that there were important logical structures within their disciplines that required context to be evaluated. Brenda argued that “Reasoning is one of the components of critical thinking but reasoning is the hard thing to define out of context.” She said that CT required in the classroom, in the laboratory or in field work required different approaches. Philip refused to define CT in general terms; he retorted, “I need to know the context of what you're actually looking for.” When evaluating CT, he said, “I go looking for context in whatever they’ve written to see what the writer means. To me, it’s one of those buzz words that means a lot of different things and you always have to figure it out.”

The role of context became even more evident in the humanities. For these faculty, even framing the lenses through which they saw their disciplines required context. As pointed out in chapter five, Steve from studio arts complained when I asked for his definition of CT as he found it difficult to define the term out of a specific context. He argued that critical thinking was “a very general subject to understand fully; I think you have to put yourself in many different states of mind and scenarios in order to understand that subject well.” Roseanne did not even think that CT existed outside context. She argued, “I think it’s a matter of each generation’s imprinting as opposed to their innate or essential qualities…CT shifts as the cognition, zeitgeist or the spirit of the age changes across the society.” Thus it became evident that faculty crossed disciplinary lines in their assumption that the conceptualization and application of CT required context.
CT is integrated with other learning outcomes.

In chapters four and five, I discussed findings that showed that faculty took an integrated approach to teaching CT. Their assumptions on the integrated nature of CT also became evident in their assessment approaches discussed in chapter six. The implicit approach that faculty adopted to CT assumed that CT was integrated with disciplinary content and other learning outcomes like the ability to comprehend, communicate, general intelligence, and wisdom to name a few. For instance, Brenda identified the ability to memorize, comprehend and interpret thinking as part of CT. Charles felt a good memory and general intelligence were part of CT. Philip recognized the ability to memorize facts and the ability to communicate their thinking so that it can be evaluated. Faculty in the humanities, too, strongly held that CT was integrated with learning outcomes that involved communication, comprehension and articulation of thoughts, ideas or self.

While it is theoretically possible to mark distinctions between disciplinary content and CT and between CT and other learning outcomes, in the practice of the classroom faculty for considerations of time or disciplinary needs, did not focus exclusively on CT. This was true of both their pedagogical and assessment approaches. Faculty do not isolate CT as part of their pedagogy or assessment practices, unless, as in philosophy, CT is taught as a separate course offering. This finding has implications for the assessment of CT and will be discussed in chapter eight.

Finding 3: Faculty’s personal epistemology influenced judgments on the outcomes of CT.

In chapters four and five I presented detailed evidence to show how closely faculty conceptualizations of CT were associated with their personal epistemology. In those chapters, I
found that faculty assumptions on the nature of the world and knowledge were closely associated with the process of justifying conclusions made as a result of the critical thinking process. I also found that faculty judgments on the outcomes of CT were related to their notions on truth and standards. However, the personal nature of personal epistemology does not readily allow for cross-disciplinary analysis. In addition, when using personal epistemology to classify codes, faculty did not fall neatly into disciplinary clusters, hence posing a challenge for such analysis. Nonetheless, I will attempt to contrast epistemologies from a philosophical perspective.

When discussing their disciplinary worlds, faculty described objective, relative and subjective qualities. They varied in their association of these qualities with their world.Analyzing the interplay between objective, relative and subjective realities revealed interesting insights into how faculty individually articulated a role for CT in their world (see chapters four and five for details). An inventive way to classify personal epistemologies was the language faculty used to express critical thought in their disciplines. Faculty in chemistry, biology, physics, and philosophy who favored the language of numbers were inclined to use rationalistic, mathematical, or statistical approaches to CT. Faculty favorably disposed to quantitative methodologies preferred to speak of objective truth and definitive realities as being the outcome of CT. Faculty who used languages that were based in linguistics and words, like romance languages, history and fine arts, leaned toward constructivism and preferred to use a critical philosophical approach to CT. The language that faculty used to evaluate critical thought was related to the criteria they used to make judgments of CT in their students. Faculty disposed to qualitative approaches talked about subjectivity, negotiating meaning, and ambiguity as goals for CT. Hence, even though faculty appeared to use the same terminology like logic or reasoning, a closer examination revealed that the languages, structures and rules of engagement that underlie
the terminology were not the same. This strengthens my claim that analyzing personal epistemology can help uncover the meaning with which faculty use the term CT or describe its components and characteristics.

When describing the nature of knowledge, faculty aligned their views to positivist, empirical, constructivist and phenomenological approaches depending on the context. Situated within the scientific process, some faculty talked about the certainty of the realities they studied and the certainty of knowledge within their disciplines. At the same time they also talked about elements of uncertainty with the methods they used to establish knowledge. They saw CT as being involved with both aspects. When dealing with the uncertainty of methods through which knowledge is created, CT was the ability to decipher truth from untruth and seek alternative explanations. Therefore, fundamentally in negotiating these complex realities in their disciplines faculty had to ask questions like what counts as sufficient justification for a claim, belief or argument? Was rationality sufficient for belief or action or did CT require additional elements?

When describing truth, some faculty highlighted objective, relative, subjective or constructed truths as being the outcome of CT. Their epistemologies varied in their beliefs about whether truth is attainable or the extent to which it is attainable. Each faculty brought unique perspectives to their judgments on the outcome of the critical thinking process. While some spoke of absolute truth, others were comfortable with the existence of multiple truths. For some like Steve, CT did not need to lead to an outcome but was the reaching a state of being or a higher state of consciousness.

I found that faculty struggled to bring all of these elements of their conceptualization of CT into their judgments on whether thinking was indeed critical thinking. In many ways the structure of the interview questions forced participants to align their disciplinary, ontological and
epistemological assumptions. This approach, in my assessment, is a good model for evaluating an individual’s conceptualizations of CT.

**Importance of this finding.**

I will underscore why examining personal epistemology is an integral plank of this study. Before I started data collection, I told myself that I would avoid bringing up the concept of truth and focus on critical thinking, as such a foray would compound my data analysis processes. After the first few interviews I realized it was impossible to dodge the issue as every faculty brought it up in their interview. On hindsight, my venture into using personal epistemology to explain faculty views on CT added an additional framework and an interesting dimension to this study and to the understanding of how faculty conceptualize CT.

In chapter one, I discussed a vignette that occurred during a research study in which I was involved which also triggered my interest to conduct this study. The vignette involved differing views among faculty raters of a student’s critical thinking as evidenced in a piece of writing. To recall, that incident made me wonder how two faculty members could use the same rubric on the same student artifact and reach different conclusions even after being trained on how to use the rubric. Central to this discussion is what I called in chapter two the *problem of judgment* - how do individuals decide what is a desired outcome of CT, what criteria do they use, and by whose standards is a desired outcome to be assessed? This finding on how faculty applied their personal epistemology when making judgments of CT is significant as it provided an answer to one of the questions that triggered the need for this study. The epistemological lenses that faculty wore clearly influenced their decision on whether the premise of thinking was critical or not. It is clear from the evidence presented here and in earlier chapters that the assumptions with which faculty approached CT need consideration as does the process used to assess CT.
Finding 4: Faculty used a hopeful pedagogy toward CT.

An important finding of this study was that faculty used what I called a hopeful pedagogy to teach and assess for CT. Elements of the hopeful pedagogy emerged when I asked faculty how confident they were that their pedagogical approaches were achieving what they intended. I have collated some of the responses from chapters four and five for effect. Here is how Brenda responded: “It (CT) is hopefully learned and people improve…I really hope students have enough background information…hopefully their critical thinking improves over time…a lot of courses are hoping students use critical thinking to appreciate the world.” She says of her methods, “In the classroom we just work problems over and over in every lecture and then hopefully they can do it themselves.” Charles said, “Our job is to teach them the knowledge that they need and hopefully they can take that and use it in critical thinking out in the real world.” Philip remarked, “I hope they pick up these portions of critical thinking and I think that is our goal, I don't know.” Paul admitted, “By the end of the course, certainly, most of our students are doing pretty good on CT; whether they remembered it long after that is another question.” Steve said of his approaches, “Well, hopefully they’ve become wiser.” It is evident that faculty taught for elements of CT applicable to their disciplinary context but had not developed ways of knowing the outcome of their efforts. They used a hopeful approach to teaching CT with no means to evaluate the efficacy of their approaches with regard to CT.

While analyzing this finding, I sought possible reasons from the data that could explain the hopeful approach. I found that a reasonable explanation required a multilayered approach. Some explanations emerged from faculty and their approaches to CT and some from the way the general education programs operate in higher education.
Focusing on faculty and their pedagogical approach, I found strong evidence that they taught for CT implicitly through disciplinary content. In addition they only focused on aspects of CT that were applicable to their disciplinary course needs. In chapter six, I discussed findings that showed that faculty did not use assessment instruments like rubrics to explicitly assess for CT in their general education courses even though some of them listed CT as an outcome in their syllabi. They approached the teaching and assessment of CT implicitly through disciplinary content, course assignments, observations, debates and other means.

While taking a constructive stance, I cannot ignore the levels of discomfort that faculty faced when I asked them about their approaches to CT. On a deeper level, there was something intriguing about the level of discomfort that faculty expressed. Philip quipped, “These aren’t the questions I thought you would ask and they’re hard for me because if that’s really your study, this is a term that I don’t use typically and try to avoid.” Brenda said, “These are kind of vague questions, so it’s a little bit hard.” Faculty in the humanities, too, indicated that they had not thought deeply about CT as a concept. Charles admitted, “These are the things you don’t think about on the day to day. I mean you occasionally contemplate it.” Steve admitted, “I didn’t think about it before you came over.” As I discussed in chapter six, none admitted to having any formal training on CT or how to teach CT. They were not aware of any programmatic, college or university efforts related to developing CT in general education. Their primary source of information on CT was gleaned from their own experimentation with CT.

On the structural issues with general education programs, faculty expressed that they were teaching in a vacuum without knowledge of what others were doing in the program. The professor of physics told me, “If you are talking about critical thinking, I tend to associate it more with the humanities.” A professor of English whom I invited to participate in the study
advised me to focus on the natural sciences as they used critical thinking more than in the humanities. In addition, as Philip remarked, “I think we are in some subset of critical thinking that is commonly used in higher education. We certainly think we try to teach critical thinking…When we are teaching, we’re teaching some subset.” In many ways, faculty saw themselves as disciplinary experts and CT in general education was larger than them.

Some faculty argued that the tenure of a semester or quarter was too short a period to teach the skills or dispositions of CT and disciplinary content. Philip said, “I worry about that by the time we are ready to learn such traits, but then it’s probably too late.” A participant in the focus group discussion said that he had no idea which foundational courses his students had already taken or where they are going after taking his course. He complained that there was no “true core curriculum” and that often students register for his courses without taking foundational courses. “What should I focus on,” he asked, “Critical thinking or teaching them the basics they should have learned in a different course?”

Philip argued similarly but from a different stance, “There are qualitative differences in the skill sets required to teach the large general education classes and just handle the mechanics of having 200 to 300 students in a class and handling supervising various graduate students or teaching assistants who are helping coordinate with that. It’s a different skill set than having anywhere from five to 15 students in an upper division class or a graduate level class.” Paul also pointed to time and the size of general education classes as a reason for his resort to quizzes and multiple-choice tests to assess for learning in philosophy.

**Chapter Summary**

From the above findings, I can conclude that disciplinary approaches, ontological assumptions and personal epistemologies influenced the way faculty from the natural sciences
and humanities conceptualized CT. The theory that emerged from the data was that within
disciplinary, educational contexts, faculty tended to focus on aspects of CT that were most
relevant to their disciplinary needs. When gauging whether thinking was critical or evaluating
the premises of arguments, faculty relied on their personal epistemologies to make such
judgments. As pointed out in chapters four and five, it is difficult to argue whether the nature of
disciplinary approaches and methods cultivated and reinforced personal epistemology or whether
it was the reverse.

The ontological assumptions faculty held on CT influenced their understanding on the
properties of the term, thereby influencing the way they operationalized CT in their classrooms.
The findings in chapter six revealed that faculty used a disciplinary approach to assess for CT.
However faculty had no real way of knowing the efficacy of their approaches, leading to what I
called the hopeful pedagogy. The study also found faculty across disciplinary lines generally
worked under the assumptions that CT was dependent on context and that it was integrated with
disciplinary content and other learning outcomes.
Chapter 8

Implications, Recommendations and Further Research

In this chapter, I will examine the implications of the findings of this study. I will also discuss my recommendations and leads for a continuing research agenda. I have categorized the implications of this study into the following sections:

- Implications for conceptual understandings of CT
- Implications of faculty development
- Implications for CT and the general education curriculum and assessment
- Implications for the Voluntary System of Accountability’s (VSA) national efforts to assess CT

Implications for Conceptual Understandings of CT

Role of personal epistemology in CT.

As pointed out in the literature review, the connections between personal epistemology and CT have only been theoretically hypothesized. Only recently Nieto and Saiz (2011) published a theoretical article calling for the expansion of the components of CT to include skills, dispositions and epistemologies on CT. They argued that while skills provide the framework for CT and dispositions, the motivations to use and apply CT, it is not always necessary that people accept the outcome of the CT process. They held that it might be necessary to examination personal epistemology and its influence on critical thinking. Batersby (1989) also argued from a theoretical stance that “it is epistemological norms and not rules of logic that constitute the philosophical core of CT.” (p. 91). She held that in most cases the claims that a
critical thinker scrutinizes are not supported by conclusions that were deduced from evidence, but by evidence that in their estimate justifies belief.

While much of the research on this subject has thus far been theoretical or anecdotal, this study presented empirical evidence that showed how closely personal epistemology was related to faculty conceptualizations of CT. It also provided empirical evidence to the claims of Nieto and Saiz (2011) in that it showed that personal epistemology is an important consideration when examining CT as a conceptual construct. It also strengthened Battersby’s (1989) claims in that personal epistemology influenced an individual’s judgments on the outcome of the CT process as evidenced in faculty in this study.

The potential utility of personal epistemology for understanding how individual’s and faculty make judgments about what constitutes CT and the means used to justify claims as a result of the critical thinking process became increasingly clear in this study. Although many have speculated on the relationship between CT and personal epistemology, this study represents one of the first empirical works to examine these speculations in the context of how faculty as assessors of CT, made their judgments.

**Revisiting the assumption that CT is discipline-general.**

I started out this study siding with the notion that CT is discipline-specific. Given the findings of this study, I now hold that the question of whether CT is discipline specific or discipline-general is passé and belonged to a time when theoretical rather than practical understandings of CT were in vogue. Given the complexity with which CT operates in higher education, the disciplinary, epistemic, ontological assumptions that influence faculty’s conceptualization of the term, the question of specificity or generality is relevant only in a theoretical sense.
Given the contested nature of the arguments and evidence on the discipline Generality or specificity of CT, there is enough evidence to conclude that at some level, CT has elements of being both discipline specific and discipline general. However, I argue from the findings of this study that this question has more than just theoretical implications. It has to be seen in the light of the realities to which CT is applied within higher education. Therefore a better question to ask is on the efficacy of a discipline general or discipline specific approach to meet the needs and aspirations of general education programs to impart a liberal and multidisciplinary education to students.

When answering the question based on efficacy, and in light of the findings of this study, I argue that an exclusive adherence to the generalist approach is dangerous for the following reasons. The discipline general approach is at best, a partial representation of how CT operated in its applied form within faculty approaches in general education. This study presented empirical evidence that showed that faculty used a disciplinary approach when conceptualizing, teaching and assessing for CT. Within that context, the application of a generalist approach to curriculum and the attempt to assess CT as discipline general is clearly at odds.

Second, the importance that faculty placed on the language through which CT is expressed created different criteria or standards of evaluation for critical thought in different disciplines. The role of language also brought into play unique rules for engaging knowledge, beliefs, ideas and arguments so that words like reasoning and logic derived multiple meanings within disciplinary contexts. Third, the generalist approach sterilizes CT from the multiple contexts of application that when applied to higher education, it can potentially create impotent thinkers - individuals who know the mechanics and skills of critical thinking but lack the ability to make application of those skills or the sensitivity to know when to apply the skills they have
acquired. Hence the application of a generalist or specific model of CT to any context in higher education must reflect the ground realities of the classroom and how faculty approach CT in general education.

Implications for Faculty Development

The study highlighted the integral role that faculty play in operationalizing CT in the classroom through pedagogy, curriculum and assessment. Hence the findings have implications for approaches for faculty development with regard to CT.

Need to make the implicit, explicit.

Faculty largely approached the teaching and assessment of CT implicitly through disciplinary content and artifacts. In addition, faculty drew from their tacitly held personal epistemologies to make judgments on CT. There are multiple underlying currents that are called into play when faculty think about or are called on to teach or assess for CT. The process of making those assumptions and connections overt and bringing those assumptions from the subliminal to the consciousness was powerful during the interview process. Faculty were re-evaluating their ideas, aligning and realigning their thoughts. Several times I heard comments like “I don’t know” “I am not sure” “is that correct?” emerge from my interviews with faculty.

The implicit disciplinary approach, the hopeful pedagogy coupled with the “I know it when I see it approach” is not particularly student friendly. General education programs assume that CT is an explicit skill that can be extracted and assessed from course work. Hence, I argue that there is a need for faculty development to focus on encouraging faculty to make the implicit, explicit.
Need to examine faculty’s ontological assumptions on CT.

This study revealed that studying the ontological assumptions that faculty hold on CT can provide useful and meaningful insights on how faculty construct their understanding of CT. What also became evident was the unanimity of assumptions held on the ontology of CT within a disciplinary cluster and the strong connection that faculty made between their ontological assumptions on CT and their pedagogy toward CT.

On the same token, the ontological commitments that faculty made to CT may be accurate or inaccurate. As Slotta and Chi (2006) claimed, an examination of an individual’s ontological commitments about a concept can help identify sources of understanding or misconception. For instance, there is a danger in focusing on knowledge as the raw material for CT in that it may not teach students to question authority (Bailin, 2004). Consequently, I argue that examining and engaging the ontological assumptions that faculty hold on the nature of CT can provide a good barometer of their understanding of the term. It can provide a solid basis for understanding disciplinary needs and differences while implementing curricular strategies and faculty training. These ontological assumptions can also be helpful to assessment personnel and provide rationale for nuanced and disciplinary interpretations of the results of CT as assessed by general education.

A model for engaging faculty to think about their approach to CT.

Looking back at the data that I collected and analyzed, I found that my approach uncovered complex, multi-layered, implicit and tacit approaches that faculty used to conceptualize and operationalize CT in their classroom. While faculty did not explicitly think about the role of their personal epistemology on their views of CT; their constructs of CT and their judgments on what should be its outcomes were not random thoughts. The weightiness of
the relationship between their personal epistemologies and their conceptualization of CT and judgments on the outcome of CT was revealed in their assumptions on the nature of the world, knowledge and knowing. It was also revealed in how faculty constructed notions on truth and the role they assigned to CT within disciplinary contexts. These aspects were clearly evident when I contrasted how faculty used personal epistemology relating to CT in chapter seven.

In chapter three and four, I showed how a certain level of the discomfort that faculty experienced could be attributed to the nature of the interview process and questions. The difficulty that faculty faced in bringing together implicit and tacit elements of their conceptualization of CT are revealed when Philip admitted, “These are the things you don't think about on the day-to-day. I mean you occasionally contemplate it.” Brenda said, “I didn't think about it before you came over.” The approach adopted in this study prompted them to articulate their understandings of the term, challenged them to align their tacit personal epistemologies, their implicit disciplinary approaches and their ontology of the term into a coherent understanding of CT. As individuals do not necessarily bring these aspects together when thinking about their thinking, it could have created a sense of unease. I see this finding as having important implications because it reinforces the need for faculty development approaches to attempt to do just that.

Most of the current approaches for training faculty on CT focus on making a particular conceptualization of CT operable or explaining how to apply an existing rubric to student work (Paul, 2005). Such an approach does not allow faculty the opportunity to think about their own conceptualizations of CT or appreciate how their own disciplinary leanings, epistemologies and ontologies impact their teaching and assessment of CT. In most cases, I found that faculty found the interview process challenging and thought provoking. I feel the approach I used in the
interviews can be a very pragmatic approach to engage faculty in discussions on their conceptualizations of CT and how it manifests in their curriculum, pedagogy and assessment practices.

**Implications for VSA Efforts to Assess CT at the National Level**

An important implication of the findings of this study is the need to seek and understand the conceptualizations and frameworks that underlie the usage of the term CT. While I respect the need that some theorists have to develop quantitative measures of CT, I argue that it must be accompanied with definitions, the limitations and consequences of using such definitions and the purposes that such definitions serve. A definition or test represents for me, a school or particular interpretation that was developed for a specific purpose. Without an acknowledgement of that context or purpose, such characterizations of CT can be dangerous and damaging to the field given the complexity of usage that this study has uncovered.

This implication has greater significance and meaning in the light of the Spellings Report’s (2006) and the voluntary System of Accountability’s call for universities to measure CT on a value added model to achieve comparability across institutions in the country using three standardized tests. It would be naive to assume that the term critical thinking as used in the three tests is comparable. A narrow definition in the hands of a psychometrician acquires measurable components with constructs of reliability and validity that soon come to define the term absolutely. As a result, a lay person or even a skilled researcher can adopt these instruments and make judgments on whether an individual, student or faculty is a critical thinker. How such measures are interpreted must be seen in the light of the conceptualization that underlies them. Palomba and Banta, (1999) too voiced this concern when they wrote that the operational definition used in an assessment model must be clarified, especially when there are multiple
possibilities to define CT. This becomes even more important when assessing CT in students and using scores to compare institutions and hold them accountable for the development of CT in students. There is need for more research on the validity and comparability of the constructs of CT used in the tests recommended by the VSA.

To recall, in chapter one, I discussed research findings by Escoe, Hall, and Nicholas (2009) that showed no correlation between the CLA (a VSA recommended test) and faculty approaches to assess for CT. This study has revealed some reasons as to why faculty approaches to assessing CT did not correlate with results produced by national, standardized, discipline-general tests. First, faculty took a developmental approach to CT. They approached CT in a freshman class differently than from a senior class. Standardized assessments cannot reflect the development of students and how they reached their goals over the undergraduate experience.

Second, within the context of the classroom, faculty teach for CT implicitly through disciplinary content and assess for it implicitly through disciplinary assignments. In addition, outcomes like CT are expressed in the preferred language for the expression of critical thought within a discipline. CT is further expressed through other learning outcomes like written, oral communication, craft or portfolios. Hence, the proficiency of a student in a disciplinary method, preferred language for the expression of critical thought and medium of communication which are factored into faculty assessment are not reflected in standardized tests or are measured exclusively using writing as in the CLA or through reading as in the Proficiency Profile. Faculty in their approach did not see CT as particularly extractable from these contexts through their pedagogical and assessment practices. However, most standardized tests and summative forms of assessment assume that CT is a distinguishable, separate skill that can be defined, assessed and taught independently.
Third, this study found that faculty across disciplines used multiple approaches to assess for CT. The most popular approach used significant pieces of student writing. While faculty from disciplines in the natural sciences and philosophy were more comfortable with identifying specific artifacts for the assessment of CT, faculty from biology, romance languages and fine arts struggled to answer the question. The nature of the assignments they identified involved a process that led up to the final product. CT was more assessable during the process than in the final product. Faculty who held to a more rationalistic conceptualization of CT highlighted of the limitations of multiple choice and Scantron to assess for CT but they appeared more inclined to tolerate its use. A scathing rejection of objective methods of assessment came from the humanities and social sciences.

Fourth, as this study found, the nature of disciplinary content, more so in disciplines in the humanities involved content that is given to perception and multiple layers of context. This brought into play the personal epistemologies of faculty into their judgments of CT. Standardized tests reduce or narrow the contextual elements of CT and as a result assess for interpretations of CT that are not meaningful to faculty and their approaches and the judgments they make of CT as disciplinary experts.

**Implications for Curriculum Development and Assessment of CT in General Education**

A multi-disciplinary vs a discipline-general approach to assess CT.

The study found that faculty assessed for CT through disciplinary content and as integrated with other learning outcomes. The integrated, disciplinary approach is not reflected in the discipline-general model adopted by most universities. This raises questions on the prevailing trend in general education that CT is discipline-general and its use of discipline-general rubrics and tests to assess for CT in all students. This study highlighted the complex nature of critical
thinking and the multiple interpretations of CT in various disciplines. While a strictly rationalistic, technicist approach to critical thinking may represent the aspirations of some disciplines, it cannot be used as the standard of measure in all disciplines. The discipline-general model provides a relatively easy means to assess CT. However, it is a pseudo representation of the multidisciplinarity of university campuses and fails to capture the complexity of the concept and further delegitimizes the investment that academia has made in teaching for CT through general education.

It must not be forgotten that the goal of a liberal education and general education in particular is to give students the widest spectrum of disciplinary exposure, and learning of the structures and rules of engagement in multiple disciplinary languages. This study has offered empirical evidence that CT is interpreted differently using multiple approaches, methods, epistemologies and contexts across disciplines and even within sub-disciplines. Therefore, the value of a liberal general education lies not in the generality of CT but its multidisciplinarity. Hence I favor a multifaceted approach to understanding critical thinking and an expansion of the scope of CT to reflect the multidisciplinarity of the term rather than its generality. As Moore (2011) similarly recommended, “This kind of wisdom from the disciplines leads one to think that the future of CT in our institutions lies not in any efforts to skate around difference but, instead, to embrace it.”

I recommend that institutions adopt a multi-disciplinary approach to assessing CT as a general education outcome as it most closely represents how faculty approach and teach for CT in their classrooms. The current general education structure provides an excellent vehicle for faculty to continue to focus on teaching for specific aspects of CT in their disciplines and students moving through a multi disciplinary curriculum will experience and engage the
multidimensional nature of CT. Such an approach will ensure that students experience and are assessed on a wider range of critical thinking capabilities and dispositions. This in my opinion will represent the aspirations of multiple disciplines adequately, be a valid representation of the critical thinking capabilities of students and help fulfill the promises of a liberal education.

Assessment of CT should factor competency in the medium of communication.

Faculty across disciplines unanimously favored assessing CT through student writing. The implication of this finding is that any interpretation of the results of assessing critical thinking should factor in the ability of a student to communicate in the medium through which critical thought is expressed. Most universities tend to assess and treat the two outcomes separately. While the skills may be assessed separately, it is important to factor in writing ability when interpreting critical thinking scores.

While this study found that faculty heavily relied on writing as the basis to assess CT, faculty in certain disciplines like biology, philosophy and fine arts disciplines preferred the use of other mediums of expression to assess for CT. However, they too naturally fell back to writing as it was normative. When one considers the research on multiple intelligences (Gardner, 1985; Sternberg, 2010), the assumption that a student’s ability to express certain skill sets through means like reading and writing are valid and reliable indicators of student ability are questioned. Hence the interpretation of student or institutional scores on CT should be seen in light of the student’s competence in the medium through which critical thought is expressed. In addition, since most general education programs assess for critical thinking through written communication; it must be pointed out that there are disciplines that use other preferred means of communication that are not represented in general education models and much less in standardized assessment approaches.
Most standardized tests and summative forms of assessment assume that CT is a distinguishable, separate skill that can be defined, assessed and taught independently. However, this study has shown that CT is a complex concept and its practice and assessment in the classroom make it impossible for faculty to separate it from other learning outcomes or disciplinary content. Its interconnectedness with disciplinary content, other learning outcomes, and the language through which critical thought is expressed, makes it difficult for faculty to assess CT in isolation. This finding raises questions on whether CT can be assessed as a distinct outcome from other disciplinary and communicative outcomes.

A contextualized, complex approach vs standardized approaches to assessing CT.

“One of the greatest challenges in assessing student learning in general education programs is addressing the tension between selecting easy-to-measure learning outcomes (Penn, 2011). Standardized tests clearly represent an easy assessment approach. Unfortunately, as is evident in current approaches used by general education programs and the VSA, we have traded quality for expediency and complexity for simplicity. Given the findings of this study, faculty unanimously rejected multiple choice questions as a means to assess CT. In many cases, they singled out standardized, multiple choice tests as lacking validity to assess CT. They held that standardized methods used to assess CT are not versatile to capture the true essence of CT. This was true even in disciplines that leaned heavily toward positivist and rationalistic understandings of CT.

As is evident from this study, the complex nature of critical thinking as a concept, its complex interaction with disciplinary knowledge, the epistemology of the thinker and the assessor of thinking calls for a complex approach to pedagogy, curriculum and assessment. The risk in using standardized approaches to assess CT is that the epistemic, ontological and
methodological assumptions that underlie such instruments may not align with how CT is operationalized in the classroom or incorporated into the general education curriculum or assessment by faculty. The use of such standardized instruments becomes a futile exercise that provides no real value in assessing for CT. This study reiterates as did the recent paper by Sternberg, Penn and Hawkins (2011, in press) that the assessment of learning outcomes in general education should adopt complex and multiple assessments.

A Continuing Research Agenda

This study has opened up new areas of interest for me as a researcher. While this study makes contributions in empirically establishing a link between CT and personal epistemology in faculty. This study delineated from analyzing the developmental aspects of epistemology espoused by Perry (1970). Given faculty views on the developmental nature of CT, research that connects the development of an individual’s epistemology with the development of critical thinkers may help explain why individuals learn to think critically but are unable to embrace the outcome of the critical thinking process.

While the disconnect or discomfort that faculty expressed in expressing their conceptualizations and with the general education program is beyond the scope of the current study, there is ample data in this study for such an analysis. There is a need to address and examine the disconnect to make the implementation of CT meaningful. Another line of research would be to examine the role that gender played in faculty conceptualizations of CT.

Summary

I argue that the concept of CT is made richer and more meaningful through the adoption of a multifaceted approach to understanding CT. How can a multifaceted understanding of CT be implemented, given the diversity and strict lines that demarcate philosophies that contribute to
understandings of CT? The answer may well reside in the forgotten dream of disciplinary diversity in general education programs. Each discipline must be allowed to express itself through the methods, languages, epistemologies and methodologies cherished by practitioners in that discipline. Further, student work developed within the context of each discipline must be assessed within disciplinary contexts and epistemologies that underlie the work.

As has become evident in this study, the contested nature of critical thinking as a concept, its complex interaction with disciplinary knowledge, the epistemology of the thinker and the assessor of thinking calls for a complex approach to pedagogy, curriculum and assessment. The study also highlights the need to meaningfully engage faculty in every stage of the assessment process. The risk in using standardized approaches to assess CT is that the epistemic, ontological and methodological assumptions that underlie such instruments may not align with how CT is operationalized in the classroom or incorporated into general education curriculum or assessment by faculty. The continued use of such standardized instruments becomes a futile exercise that provides no real value to learning or to practices used by faculty in the classroom. This study reiterates that the assessment of CT in general education should adopt complex and multiple assessments. While it is difficult to identify the shape that new assessment models to critical thinking should take, a simplistic response is one that higher education can ill afford in this age of accountability.
References


Retrieved Jan 02, 2009, from Professional Development Collection database.


Nicholas, M. C. (2009). Examining conceptualizations, dimensions and theoretical frameworks that inform conceptualizations of critical thinking. Unpublished manuscript, College of Education and Criminal Justice, University of Cincinnati, Cincinnati, OH.


*Inquiry: Critical Thinking Across the Disciplines, 21*, 5-16.


1. In your own words, what does the term critical thinking mean to you?
   a. Could you give me an out of school example of critical thinking?
2. What according to you are the characteristics of a good critical thinker?
   a. Could you describe them further?
   b. Do you have any other characteristics you would like to add?
3. Why do you think the characteristics you described are important for critical thinking?
4. If you were to explain critical thinking to undergraduate students in your discipline, what would you say to them?
5. If you were to explain to undergraduate students how to become a critical thinker in your discipline, what would you say to them?
6. Could you tell me about a student in your discipline who was a good critical thinker?
   a. Is there anything else you remember?
7. When you teach for CT, what do you hope your students will be able to do within the context of your discipline?
   a. Why is that important to you?
8. How do you assess for critical thinking within the context of the courses that you teach?
   a. Do you use any instrument(s) to assess for CT in your courses?
   b. If yes, what and why? If no, why not?
9. What core characteristics, when evident, send a red flag that the student is not a good critical thinker?
a. Does anything else come to mind?

10. Take me through the process you use to grade a student artifact for critical thinking.
Appendix B

Brief Participant Questionnaire

Discipline:  

Years of teaching experience:  

Gender:  

1. Are you aware whether your department has a definition of CT? (Yes / No)  
2. Are you aware whether your college has a definition of CT? (Yes / No)  
3. Are you aware whether your university has a definition of CT? (Yes / No)  
4. As faculty, were you formally trained to teach for CT in the classroom? (Yes / No)  
5. How many years of teaching experience do you have at the undergraduate level?  
6. Would you be open to me contacting you with my findings so that you can verify if I have represented your views accurately? (Yes / No)  
7. If you answered yes to Question 5, please also provide your email address so that I can contact you:  

Name:  

Email:
Appendix C

Focus Group Discussion Prompts

1. How did you define the term critical thinking while operationalizing it in your classroom and assessment approach?
2. What pedagogical approaches did you use to implement CT in your course?
3. How did you assess for CT in your course?
4. Did you use any rubrics or other assessment instruments to assess for CT?
5. What were difficulties you faced in implementing your approach?
6. What did you learn from your experience in designing your course to teach and assess for CT?
7. What would you change about your approach for the future?
Appendix D

Recruitment Letter for Individual Interviews

Dear _____________,

My name is Mark Nicholas and I am a doctoral candidate in Educational Studies at the University of Cincinnati. I am working on my dissertation study that will investigate how faculty from different disciplines conceptualize and assess for critical thinking.

The project will require approximately one hour of your time. During this period, you will meet with me for a one-on-one interview at a location of your convenience. During the interview we will discuss your own conceptualizations of critical thinking and how you assess for it within the context of your discipline. I would also request your permission to audio record the interview to help me transcribe and interpret your thoughts accurately in my research. While audio recording is desirable, it will not preclude your participation in this study. As researcher, I will maintain confidentiality and anonymity of all data collected from the interviews.

I will also request you to evaluate a student artifact for critical thinking prior to the interview. I will not need to see/evaluate the student artifact but would be interested in discussing the process you used to assess for CT. This is intended only to provide a framework for our discussion. I would also request you to share with me any instruments/tests/rubrics that you use to assess critical thinking in your courses.

I would like to invite you to participate in this project. However, you are under no obligation to do so. If you decide to participate, please let me know via email. If you would like to speak with me or if you have further questions, please contact me at 513-532-4463 or email me at nicholmo@ucmail.uc.edu.

Regards,

Mark Nicholas
Doctoral Candidate, Educational Studies
University of Cincinnati
Appendix F

Recruitment Letter (Focus Group Discussion)

Dear _____________,

My name is Mark Nicholas and I am a doctoral candidate in Educational Studies at the University of Cincinnati. I am working on my dissertation study that will investigate how faculty from different disciplines conceptualize and assess for critical thinking.

The project will require approximately one hour of your time. During this period, you will meet with five other faculty members from your discipline to discuss your conceptualizations of critical thinking and on how you assess for it within the context of your discipline. I would also request your permission to audio record the discussion to help me transcribe and interpret your thoughts accurately in my research. Given the collective nature of this mode of data collection, I will only recruit participants willing to have the discussion audio recorded.

As researcher, I will maintain confidentiality and anonymity of all data collected from the discussions. **However, I will not be able to guarantee that any statements made in the focus groups will be held private and confidential by any other subjects in the focus group, even though the PI will hold them confidential.**

I will also request you to evaluate a student artifact for critical thinking prior to the interview. I will not need to see/evaluate the student artifact but would be interested in discussing the process you used to assess for CT. This is intended only to provide a framework for our discussion. I would also request you to share with me any instruments/tests/rubrics that you use to assess critical thinking in your courses.

I would like to invite you to participate in this project. However, you are under no obligation to do so. If you decide to participate, please let me know via email. If you would like to speak with me or if you have further questions, please contact me at 513-532-4463 or email me at nicholmo@ucmail.uc.edu.

Regards,

Mark Nicholas
Doctoral Candidate, Educational Studies
University of Cincinnati
Appendix G

Adult Consent Form for Research
University of Cincinnati
Department: Educational Studies
Principal Investigator: Mark Nicholas. Faculty Advisor: Miriam Raider-Roth

Title of Study: Conceptions of Critical Thinking Held by Faculty in the Humanities, Social Sciences and Natural Sciences – A Grounded Theory Study

Introduction:
You are being asked to take part in a research study. Please read this paper carefully and ask questions about anything that you do not understand.

Who is doing this research study?
The person in charge of this research study is Mark Nicholas of the University of Cincinnati (UC) Department of Educational Studies.

What is the purpose of this research study?
The purpose of this research study is to understand how faculty from the Humanities, Natural Sciences, and Social Sciences conceptualize critical thinking and how they assess for it in the classroom.

Who will be in this research study?
About 40-45 faculty members will take part in this study.

What will you be asked to do in this research study, and how long will it take?
You will be asked to either participate in a one-on-one interview with me or to participate in a focus group discussion with me and 5 other faculty in your discipline. Interviews and focus groups will discuss your conceptualizations of critical thinking and how you assess for it in your discipline. Interviews and focus group discussions will take approximately 1 hour. The interviews and group discussions will take place on the university campus at the participant’s campus office or a private conference room.

Individual Interview Participants
Your permission is requested to audio record the interview. While audio recording is desirable, it will not preclude participation in this study. Confidentiality and anonymity of data will be maintained.

Group discussion participants
Your permission is requested to audio record the discussion. Given the collective nature of this mode of data collection, only participants willing to have the discussion audio recorded will be recruited. The PI will maintain confidentiality and anonymity of all data collected from the discussions. However, no guarantee is made that any statements made in the focus groups will be held private and confidential by any other subjects in the focus group, even though the researcher will hold them confidential.
Are there any risks to being in this research study?
It is not expected that you will be exposed to any risk or discomfort from participating in this study. You have the option to withdraw from the study at any stage. If you choose to withdraw, any data collected from you will not be represented in the research analysis.

Are there any benefits from being in this research study?
You will receive no direct benefit from your participation in this study.

Will you have to pay anything to be in this research study?
You will not need to pay anything to participate in this study.

What will you get because of being in this research study?
No benefits are anticipated for being involved in this study.

Do you have choices about taking part in this research study?
Your participation in this study is voluntary.

How will your research information be kept confidential?
Information about you will be kept private and in a locked file cabinet in the office of the researcher’s faculty advisor at the University of Cincinnati. Only the principal investigator will have access to any identifying data collected from you. Research data will be stored in a locked file cabinet for three years after the end of this study and then will be destroyed by shredding. The data from the study may be published; or presented at a conference. However, you will not be identified by name or affiliated institution.
Agents of the University of Cincinnati may inspect study records for audit or quality assurance purposes.

What are your legal rights in this research study?
Nothing in this consent form waives any legal rights you may have. This consent form also does not release the investigator, the institution, or its agents from liability for negligence.

What if you have questions about this research study?
If you have any questions or concerns about this research study, you should contact me Mark Nicholas at nicholmo@ucmail.uc.edu or 513-532-4463 or my faculty advisor, Miriam Raider-Roth at miriam.raider-roth@uc.edu or 513-556-3808.

The UC Institutional Review Board – Social and Behavioral Sciences (IRB-S) reviews all non-medical research projects that involve human participants to be sure the rights and welfare of participants are protected.

If you have questions about your rights as a participant or complaints about the study, you may contact the Chairperson of the UC IRB-S at (513) 558-5784. Or, you may call the UC Research Compliance Hotline at (800) 889-1547, or write to the IRB-S, 300 University Hall, ML 0567, 51 Goodman Drive, Cincinnati, OH 45221-0567, or email the IRB office at irb@ucmail.uc.edu.
**Do you HAVE to take part in this research study?**

No one has to be in this research study. Refusing to take part will NOT cause any penalty or loss of benefits that you would otherwise have. You may start and then change your mind and stop at any time. To stop being in the study, you should tell Mark Nicholas at nicholmo@ucmail.uc.edu or 513-532-4463. Data collected from you will not be used in the data analysis in such cases.

**Agreement:**

I have read this information and have received answers to any questions I asked. I give my consent to participate in this research study. I will receive a copy of this signed and dated consent form to keep.

Please check one of the following:

- [ ] I agree to having my interview audio recorded
- [ ] I do not agree to having my interview audio recorded
- [ ] I agree to having the group discussion audio recorded
- [ ] I do not agree to having the group discussion audio recorded

Participant Name (please print) ____________________________________________

Participant Signature __________________________ Date _________

Signature of Person Obtaining Consent _____________________ Date _________