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**The relationship between personal epistemology and accountability
on critical thinking disposition**

by

Alice Kathleen Peterson

**A Dissertation Submitted to the
Graduate Faculty in Partial Fulfillment of the
Requirements for the Degree of
DOCTOR OF PHILOSOPHY**

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ABSTRACT

The intent of this study was to examine the relationship between personal epistemology, complexity of thought given three different levels of accountability instruction, and critical thinking dispositions. Each of these areas has been examined in the literature separately, but the relationship between them has never been investigated.

The participants consisted of 128 undergraduates, 81 female and 47 male, all of whom had earned sixty or more semester credits and were all enrolled in a required interdisciplinary seminar at a small private liberal arts college in the midwest.

Personal epistemology was measured by the Learning Environment Preference (Moore, 1987), which is based on William Perry's stages of intellectual development. The integrative complexity of thought was measured by the Integrative Complexity Code developed by Schroder, Driver, & Streufert (1967). Critical thinking dispositions were measured by the California Critical Thinking Disposition Inventory (Facione, & Facione, 1992).

The study was a 2×3 factorial design. The data were analyzed using an analysis of variance to compare personal epistemology, complexity of thought, and critical thinking dispositions. Correlations were also computed to examine relationships between demographic variables and the other variables.

Significant results showed participants who hold the personal epistemological belief that knowledge is constructed or relativistic have stronger dispositions toward critical

thinking than do participants who hold the personal epistemological belief that knowledge is absolute or concrete. Older students write significantly more integratively and have higher dispositions toward critical thinking. Holding participants accountable for a position on an issue had no significant impact on critical thinking dispositions. Finally, the participants whose attitudes demonstrated the greatest shift in the semester course were those who hold the epistemological belief that knowledge is concrete or absolute. All seven subscales of the California Critical Thinking Disposition Inventory had higher posttest means than pretest means for participants who believed knowledge is absolute or concrete.

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CHAPTER 1: INTRODUCTION

Introduction

American higher education in the last decade has been barraged with critical reports containing at least two consistent criticisms: a) The focus on disciplines in higher education has fragmented the approach to education such that there is no common base of knowledge taught to undergraduates, and b) students are not taught to think critically about what they read or encounter (Bennett, 1984; Bloom, 1987; Boyer & Levine, 1981; Cheney, 1989; D'Souza, 1991; Hirsch, 1987).

The focus of this study is to examine the second concern relating to critical thinking, specifically, how personal epistemological beliefs about knowledge and the expectation of having to defend one's point of view impact attitudes or dispositions toward learning.

There have been a variety of responses to the concern for teaching critical thinking in American education. Two regional centers for critical thinking have been developed, The Institute for Critical Thinking in Upper Montclair, New Jersey and The International Center for Critical Thinking at Sonoma State University, Sonoma, California, both of which conduct research in critical thinking. One state system, California, requires all undergraduates to take nine credits of critical thinking or its equivalent (Moore, 1983). The College Entrance Examination Board and the Educational Commission of the States demonstrated their concern for critical thinking by identifying reasoning as a basic competency for all college bound students in the pamphlets Academic Preparation for College (1983) and Action for Excellence (1983) respectively. Conferences such as The 12th Annual International

Conference on Critical Thinking and Educational Reform (1993) at Sonoma State University with the theme "Cultivating the Reasoning Mind: Kindergarten - Graduate School", demonstrates the broad concern for infusing critical thinking in education. The need to infuse critical thinking skills into the educational process was presented as vital for students, for the continuation of a democratic society, and for a competitive work force in a new global economy. Business and industry are also concerned about the teaching of critical thinking to future employees as evidenced by the comments of John Sculley, Chief Executive Officer for Apple Computer, Inc. at a presidential economic conference in 1992. Sculley identified the most strategic resources for a new economy as ideas and information that come from our minds. "Our public education system has not successfully made the shift from teaching the memorization of facts to achieving the learning of critical thinking skills" (Sculley, 1992, p.2). Implicit in these responses is the assumption that there is a clear definition of critical thinking skills, and that these skills can be taught.

Indeed, the most focused definition of critical thinking has come from the American Philosophical Association, who in 1987 began the Delphi Project directed by Peter Facione to make a systematic inquiry into the state of critical thinking and critical thinking assessment. The publication, Critical Thinking: A Statement of Expert Consensus for Purpose of Educational Assessment and Instruction, (1990) culminated the work of forty-six experts in critical thinking. The experts defined, by consensus, critical thinking and the ideal critical thinker.

We understand critical thinking to be purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as

explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based.... The ideal critical thinker is habitually inquisitive, well-informed, trustful of reason, open-minded, flexible, fair-minded in evaluation, honest in facing personal biases, prudent in making judgments, willing to reconsider, clear about issues, orderly in complex matters, diligent in seeking relevant information, reasonable in the selection of criteria, focused in inquiry and persistent in seeking results which are as precise as the subject and the circumstances of inquiry permit. (Facione, 1990 p.3)

According to this definition there are two elements to critical thinking: (a) a set of skills for generating and processing information and (b) habits of mind or dispositions which use the skills to guide behavior based on intellectual commitment.

A survey of the critical thinking literature reveals the greatest amount of attention has been spent defining and teaching the skills of conceptualization, analyzing, synthesizing, applying and evaluating information. A review of the critical thinking textbooks also reveals a clear consistent long-standing emphasis: teaching critical thinking is teaching the mechanics of reasoning and logic including identifying premises and assumptions; drawing inferences; and interpreting data (Barry, 1984; Beardsley, 1956; Black, 1956; Chaffee, 1991; Dewey, 1910; Ennis, 1969; Fawcett, 1938; Glaser, 1941; Higgins, 1945; Lewis, 1950; Nosich, 1982; Passmore, 1967; Paul, 1988; Peel, 1973; Schaaf, 1955; Schievella, 1968).

Hartman and Barell (1985) examined the thinking programs listed in the Association for Supervision and Curriculum Development Network Directory and found only twelve of the fifty-four schools included attitudes or dispositions toward thinking as major program goals in the critical thinking program. Less than one-fourth of the critical thinking curriculums focused on student's attitudes about thinking as a major goal in the critical

thinking program.

Research on critical thinking dispositions therefore is limited, and the inclusion of critical thinking dispositions as opposed to critical thinking skills in critical thinking programs is undervalued. Certainly skill in critical analysis is a necessary condition for comprehension of academic texts and for dialogical exchange with intellectuals but it is not a sufficient condition. For example, an unscrupulous thinker taught only the skills of reasoning becomes simply a more systematic unscrupulous thinker. A student with good memory skills who becomes a master of logical analysis has been "vulcanized by the calculus of justification" in Walters' terms, meaning the student devalues imagination, insight and intuition (Walters, 1990a, p.456). Critical thinking requires more than just skill in applying the rules of formal logic. Browne & Keeley (1990), Ennis (1989), Walters (1990a), Weinstein (1988), and Yinger (1980) all described critical thinking dispositions, defined as attitudes toward thinking, as important components of critical thinking.

Ennis (1987,1989) urged an expansion in critical thinking research to include exploratory research on critical thinking dispositions, particularly what fosters the attitudes toward thinking critically. There is a paucity of educational research examining conditions that might foster or enhance critical thinking dispositions. Baron (1987) described the area of critical thinking dispositions as an important and timely area for research which could improve the effectiveness of instruction and learning in the classroom. Wells (1990) argued that literate thinking required appropriate dispositions to engage a text.

Critical thinking dispositions, attitudes toward thinking, and the factors which foster

these attitudes as defined by the Delphi Project (1990) were of concern in this research. There is limited research concerning what fosters attitudes toward learning in educational literature. To assist in gaining insight into factors which may foster critical thinking dispositions, the domain of cognitive social psychology, particularly the area of accountability, may be helpful as it examines attitude changes.

Of interest for this study was the relationship between accountability as a pedagogical technique, complexity of thought, and critical thinking dispositions. Tetlock (1983a, 1986a, 1986b) explored the impact of accountability - the need to justify one's views to others - on the complexity of college students' thinking on controversial issues. Subjects who were accountable to an individual whose views on a social issue were unknown thought about the social issue in more integratively complex ways as they anticipated alternative points of view. Subjects tended to engage in preemptive self-criticism by anticipating counter arguments and objections that could be raised to their position. Other accountability studies have substantiated a significant relationship between the justification of one's views to another with more realistic statements of self-confidence and more integratively complex thinking in undergraduate students (Tetlock & Boettger, 1989; Tetlock & Kim, 1987; Tetlock, Skitka, & Boettger, 1989). Students who are accountable to another whose views they do not know will think more systematically, focus their inquiry, and draw reasoned conclusions.

What has not previously been examined is the relationship between accountability and critical thinking dispositions. Accountability (the need to justify one's views to others) could lead students to preemptive self-criticism resulting in more complex thinking which may

foster or enhance attitudes toward thinking such as the desire to seek truth, being open-minded, being intellectually curious, being fair-minded, and making reflective judgments which are critical thinking dispositions.

Complexity of thinking in undergraduates, Greeno (1989) suggested, was in part dependent upon a students' personal epistemological belief, the belief one holds about the nature of knowledge. This finding furthers Dweck (1983, 1988) and her associates study which demonstrated even children hold different attitudes about the nature of knowledge and those epistemological beliefs affected their attitudes toward cognitive tasks. The work by William Perry (1970) defined stages of intellectual development in undergraduates based on qualitatively different modes of inquiry about the nature of knowledge. Students progress from understanding knowledge as certain and absolute to understanding knowledge as constructed phenomenon given contextual observations. Belenky, Clinchy, Goldberger and Tarule (1986) added to the understanding of epistemological development by describing women's intellectual development. A contemporary gender balanced study by Baxter-Magolda (1993) substantiated the general stages of intellectual development in Perry's model but her Epistemological Reflection Model identified different strategies of knowing within each stage of development. It is clear from these intellectual development studies there is a progression of intellectual development and that each stage is framed by a core assumption about the nature of knowledge. What is missing in each of these studies is a discussion on the students' attitude or disposition toward thinking. It is possible that one's personal epistemology may have impact on one's disposition for critical thinking. For example, if a

student believes knowledge is certain or absolute they may display less inquisitiveness or flexibility in their critical thinking. Likewise, a disorderly thinker who does not consider alternative points of view may hold a personal view of knowledge as certain or absolute, meaning there must be one right answer and one must try to find "it".

Statement of the Problem

Research concerning what alters or fosters critical thinking dispositions is limited. Accountability as a pedagogical technique appears to foster attitudinal change but has never been used to assess attitudes or dispositions toward critical thinking. In addition, one's personal epistemological belief appears to have a relationship to one's disposition toward critical thinking but this relationship has not been specifically explored.

The problem for this study was to examine the relationship in undergraduates between personal epistemology and levels of accountability on the critical thinking dispositions defined by the Delphi Project (1990) as truth-seeking, inquisitiveness, open-mindedness, confidence, analyticity, systematicity, and cognitive maturity.

Statement of the Purpose

The purpose of this study was three-fold. First, the study explored whether there was a relationship between personal epistemological beliefs (specifically whether one believes knowledge is certain or whether one believes knowledge is constructed) and critical thinking dispositions as defined by the Delphi Project (1990). Second, the study examined the

relationship between undergraduates complexity of thinking demonstrated in written responses to questions given three different sets of instructions regarding to whom they would have to justify their point of view and critical thinking dispositions as defined by the Delphi Project (1990). Third, the study examined the interaction between personal epistemological belief and complexity of thinking on critical thinking dispositions.

Research Questions

Investigating the impact of personal epistemologies and levels of accountability on critical thinking dispositions raised the following questions:

Question 1: Is there a difference in critical thinking dispositions between students who hold the personal epistemological belief that knowledge is absolute or certain and the students who hold the personal epistemological belief that knowledge is relativistic or constructed?

Question 2: Is there a difference in critical thinking dispositions for students: (a) who are informed they will be accountable to another individual whose views they do not know on a reading, (b) who are informed they will not have to publicly justify their views on a reading, and (c) who are informed they will be involved in a small group discussion prior to being accountable to another individual whose views they do not know on a reading?

Question 3: Is there a difference in the integrative complexity of thinking reflected in writing between students who are told they are accountable for their point of view compared to students who are not held accountable or are in a small group discussion?

Question 4: To what extent do personal epistemological beliefs (knowledge is certain or absolute or knowledge is relativistic and constructed) and levels of accountability and integrative complexity interact in impacting students critical thinking dispositions?

Statement of Assumptions

Based upon the literature the following assumptions were held at the beginning of this study:

1. Students' epistemological beliefs are stable enough to be reliably discerned at a single point in time.
2. Critical thinking dispositions are attitudes about thinking and can be reliably evaluated by an objective measure.
3. An essay can demonstrate a students' ability to differentiate and integrate information about a concept.
4. Levels of complexity can be reliably assigned to students' essays on the basis of differentiation and integration.

Limitations of the Study

Many factors can foster or alter critical thinking dispositions. This study is limited by the variables chosen for analysis, specifically the pedagogical technique of accountability and the theoretical framework of personal intellectual development as identified by William Perry. It is also limited by the size of the sample and the nature of the academic institution, a small, private four-year midwestern college which admits students with a wide variety of academic backgrounds. The validity and reliability of the data are also limited by the validity and reliability of the instruments used to collect the data, the Learning Environment Preference, the Integrative Complexity Coding System, and the California Critical Thinking Disposition

Inventory.

Definition of Terms

1. Critical thinking for this study is defined as purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based.
2. A disposition is a mental stance, habit, or attitude with which one approaches events, issues, and experiences.
3. Critical thinking dispositions are the dispositions of being habitually inquisitive, well-informed, trustful of reason, open-minded, flexible, fair-minded in evaluation, honest in facing personal biases, prudent in making judgments, willing to reconsider, clear about issues, orderly in complex matters, diligent in seeking relevant information, reasonable in the selection of criteria, focused in inquiry, and persistent in seeking results which are as precise as the subject and the circumstances of inquiry permit. The California Critical Thinking Disposition Inventory has summarized the dispositions in seven subscales: truth-seeking, open-mindedness, analyticity, systematicity, self-confidence, inquisitiveness, and maturity. (See Appendix A)
4. Accountability is the need to justify one's views to others.
5. Integrative Complexity is defined in terms of two cognitive properties: differentiation and integration. The complexity of integration depends on whether the individual

perceives differentiated characteristics in isolation, in simple interactions, or in multiple contingent patterns.

6. Differentiation refers to the number of evaluatively distinct dimensions of a problem that an individual takes into account.
7. Integration refers to the development of complex connections among differentiated characteristics. Differentiation is therefore a necessary condition for integration.
8. Personal epistemological beliefs are beliefs one holds about the nature of knowledge. Baxter-Magolda (1992) summarizes the positions and core assumptions about knowledge as follows:

<u>Position</u>	<u>Assumption</u>
Absolute knowing	Knowledge is certain and absolute.
Transitional knowing	Knowledge is partially certain, partially uncertain.
Independent knowing	Knowledge is uncertain; everyone holds their own belief.
Contextual knowing	Knowledge is judged on the evidence in context.

Kurfiss (1988) integrated the Perry model of intellectual development with the work of Belenky and associates (1986) and summarized the stages of intellectual development as follows:

<u>Stage</u>	<u>Assumption</u>
Dualism/received knowledge	Knowledge is a collection of discrete facts.
Multiplicity/subjective knowledge	Knowledge claims conflict; one claim is as good as another.

Relativism/procedural knowing	Truth claims vary in quality depending upon the frame of reference in evaluation.
Commitment in relativism/constructed knowledge	Individuals take positions and make commitments to them often on the basis of what is learned.

9. Upper division undergraduate students are college students who have earned sixty or more academic semester hours but who have not completed a baccalaureate degree.

Significance of the Study

Richard Paul, director of the Center for Critical Thinking and Moral Critique at Sonoma State University argues that the ancient teaching strategies of rote learning and didactic teaching have produced severe negative consequences that are impacting business and industry, political and civic life, and personal and family life.

Many public and private problems can be attributed to the low level of thinking that dominates public life. Intellectually undisciplined, narrow-minded thinking will not solve increasingly complex, multi-dimensional problems let alone provide the basis for democratic decision-making. The cost of the growing mass of uncritical thinkers as workers and citizens is staggering. (Paul, 1990, p.2).

The need to teach critical thinking skills in colleges and universities has been cited in the last two decades in numerous studies (Chaffee, 1991; Costa, 1985; Ennis, 1981; Gardner, 1983; Lipman, M., Sharp, A.M. & Oscayan, F., 1977; Norris & Ennis, 1989; Paul, 1990; Ruggerio, 1988; Scriven, 1985; Sheffler, 1973; Siegel, 1988; Sternberg, 1985a, 1985b, 1986; Walters, 1986). The primary focus has been on developing the skills of logic and reasoning. To improve the quality of thinking in an undergraduate classroom also requires

understanding students' dispositions toward thinking. Solving complex, multi-dimensional problems requires a flexibility in thinking and a persistence in seeking fair, reasonable solutions. Solutions to future complex problems will require the construction of new knowledge. Students who believe knowledge is absolute rather than constructed therefore, will have difficulty in problem solving.

This study will provide information about the differences in critical thinking dispositions among students whose personal epistemological beliefs vary and who are held to different levels of accountability for their views on a controversial issue. This information could be used by educators to improve the effectiveness of instruction in the undergraduate classroom. If levels of accountability improve the complexity of thinking, students could be provided exercises and assignments which foster complex thinking such that they are more disposed to attack and persist in solving complex, multi-dimensional problems. Instruction could also be improved to stimulate the intellectual growth of students.

The results of this study may also have implications for student affairs personnel in creating staff development training. Dispositions toward learning, one's personal epistemological belief, and one's complexity of thinking may be key variables in teaching problem-solving skills to student personnel in co-curricular activities. Solving complex, multi-dimensional problems are as much a part of the undergraduates out-of-class experience as their in-class experience.

This study, by drawing on research from different disciplines, may also add to the knowledge of elements that foster critical thinking dispositions.

CHAPTER 2: REVIEW OF THE LITERATURE

Introduction

The purpose of this study was threefold: first, to examine the relationship between personal epistemological beliefs and given critical thinking dispositions; second, to examine the relationship between the complexity of thinking in an essay given three levels of accountability instruction and critical thinking dispositions; and third, to examine the interaction effect of personal epistemological belief and complexity of thinking on critical thinking dispositions.

The literature review is divided into four sections. The first section describes the development of critical thinking dispositions. Section two presents the background leading to the social contingency model of judgment and choice that frames the accountability model. The third section is a review of selected research on student intellectual development. This research is limited to William Perry's model and those who have extended the Perry model. The fourth section is a summary of the review process.

Critical Thinking Disposition Development

Long before the 1990 American Philosophical Association's Delphi Project, which formulated a concise definition of critical thinking incorporating both skill and disposition elements, there were scholars suggesting that attitudes toward learning or habits of mind as some call them, could profoundly impact the quality of thinking.

Bloom and Broder (1950) identified a good problem solver as one with the habits of mind of aggressiveness, confidence, tenacity, attention to detail, and faith in reason. It can be argued that Krathwohl, Bloom, and Masia (1964) had critical thinking dispositions in mind when they constructed the affective domain of higher order thinking skills in the Taxonomy of Educational Objectives. The affective domain contains objectives such as: a willingness to learn and try a particular behavior (receiving); valuing a response and acting on the value with commitment (responding, valuing); organizing values based on inter-relationships of experiences and integrating values into a flexible, adaptable philosophy or world view (organization and characterization).

Burton, Kimball, and Wing (1960) summarized the critical attitudes necessary for good thinking as: intellectual curiosity, intellectual honesty, acceptance of responsibility for process and result, objectivity, intelligent skepticism or suspension of judgment, criticalness, open-mindedness, conviction of universal cause-and-effect relationships, disposition to be systematic, flexibility, persistence, and decisiveness. These authors were certain that critical thinking dispositions could and should be engendered in an educational environment.

Adams (1974), in describing effective thinking, identified two areas which block effective thinking, personal biases and personal values. More specifically, the impediments to effective thinking include: fear of making a mistake, fear of failing, the inability to tolerate ambiguity or disorder, premature judgment, and the need for quick success. Adams added that effective thinking could be achieved with a conscious effort.

Sternberg (1986) identified several emotional and motivational blocks to critical

thinking which included dispositions such as fear of failure, lack of follow-through, task completion difficulties, misattribution of blame, lack of perseverance, procrastination, and too little or too much self-confidence. Sternberg has developed a critical thinking text which contains a chapter devoted to the failure of mental self-management. In the chapter Sternberg identifies strategies that will lead to positive mental self-management. The suggestions in effect amount to strategies that foster critical thinking dispositions.

Ennis (1987) has itemized a taxonomy of critical thinking dispositions which influence the development of critical thinking skills. The fourteen dispositions include:

1. Seek a clear statement of the thesis or question.
2. Seek reasons.
3. Try to be well informed.
4. Use and mention credible sources.
5. Take into account the total situation.
6. Try to remain relevant to the main point.
7. Keep in mind the original and/or basic concern.
8. Look for alternatives.
9. Be open-minded by being able to: (a) Consider seriously other points of view than one's own (dialogical thinking), (b) reason from premises with which one disagrees without letting the disagreement interfere with one's reasoning (suppositional thinking), and (c) withhold judgment when the evidence and reasons are insufficient.

10. Take a position (and change a position) when the evidence and reasons are sufficient to do so.
11. Seek as much precision as the subject permits.
12. Deal in an orderly manner with the parts of a complex whole.
13. Use one's critical thinking abilities.
14. Be sensitive to the feelings, level of knowledge, and degree of sophistication of others.

Nickerson, Perkins, and Smith (1985) speak about the importance of attitudes which might enhance thinking. These attitudes include a lively sense of curiosity and inquisitiveness; a willingness to evaluate claims in light of evidence, think through things, and to modify one's views when evidence indicates such a need; a commitment to figure things out; a respect for others opinions; and acceptance of the idea that winning arguments is less important than arriving at conclusions supported by fact.

Walters (1990a) identified logical inference, critical analysis, and problem solving as factors that are necessary but not sufficient for critical thinking. Defining critical thinking as analytic reductionism, Walters termed this model the "calculus of justification" model and found it far too narrow. The more realistic definition of critical thinking must be broadened to include the factors of imagination, insight, and intuition, a model Walters terms the "pattern of discovery." A successful critical thinker would (a) possess the skills of both the rationality model plus the discovery model and (b) display the dispositions of flexibility in approaching problems, adaptability in applying solutions in familiar as well as novel

situations, tolerance of dissenting perspectives, cognitive daring which would analyze arguments and knowledge claims as well as envision alternative ideas and problems, and tolerance for ambiguity. Browne and Keeley (1990) identified five attitudes found in good critical thinkers: (a) intellectual curiosity (looking for causes and answers), (b) open-mindedness to multiple realities (seeking out and respecting alternative viewpoints and perspectives), (c) flexibility (willingness to change an opinion in the face of strong reasoning), (d) humility concerning beliefs (recognizing that certainty is almost always an illusion), and (e) intellectual skepticism (requiring support for claims and opinions before adopting them).

To be certain, there is sufficient literature that consistently describes the dispositions of a critical thinker. A summary list of critical thinking dispositions supported by experts in critical thinking would include: flexibility in considering alternative opinions; willingness to reconsider and revise a point of view when evidence suggests a change is warranted; reasonableness in selecting criteria while searching for truth; willingness to hear and examine divergent points of view; willingness to honestly face one's own biases, prejudices, stereotypes, and egocentric tendencies; trust in the processes of reasoned inquiry; clarity in stating questions or concerns; persistence in thinking through an issue when difficulties are encountered; diligence in seeking relevant information; careful focusing of attention in working with complexities; self-confidence in one's ability to reason; desire to inquire about a wide range of issues; desire to be generally well informed; fair-minded; prudence in suspending, making, or altering judgments; precision in conclusions as far as the subject or circumstance allows.

This summary list bears marked resemblance to the summary of the ideal critical thinker in the Delphi Project, as crafted by Peter Facione, representing the consensus opinion of forty-six experts in critical thinking. The ideal critical thinker is

... habitually inquisitive, well-informed, trustful of reason, open-minded, flexible, fair-minded in evaluation, honest in facing personal biases, prudent in making judgments, willing to reconsider, clear about issues, orderly in complex matters, diligent in seeking relevant information, reasonable in the selection of criteria, focused in inquiry and persistent in seeking results which are as precise as the subject and the circumstances of inquiry permit....
(Facione, P. 1990 p.3)

The California Critical Thinking Disposition Inventory (CCTDI, 1992), developed by Peter and Noreen Facione, categorizes the ideal critical thinker into seven subscales and is summarized in Table 1. While the literature is clear that critical thinking dispositions exist and can enhance thinking, there is no consensus about the development or malleability of these dispositions.

Accountability Model

There is a foundation of literature that examines cognitive structure and processing rules that people use to examine information which might prove helpful in learning about critical thinking dispositions (Fiske & Taylor, 1984; Forgas, 1982; Higgins & McCann, 1984; Markus & Zajonc, 1985; Nisbett & Ross, 1980; Tetlock, 1985a). Some research has suggested a social contingency model of judgment and choice which assumes people to be "cognitive misers," (i.e., using the least amount of cognitive effort possible). These people rely on simple, low-effort heuristics that allow them to make choices and decisions quickly

Table 1. Comparison of CCTDI and the Delphi Consensus

CCTDI subscale	Dispositions	Delphi consensus
1. Truth-seeking	<ul style="list-style-type: none"> - being eager to seek truth - courageous about asking questions - honest and objective about pursuing inquiry 	<ul style="list-style-type: none"> - willingness to reconsider and revise one's views where honest reflection suggests that a change is warranted - reasonableness in selecting and applying criteria - flexibility in considering alternatives and opinions
2. Open-mindedness	<ul style="list-style-type: none"> - open-minded and tolerant of divergent views - sensitivity to one's own bias 	<ul style="list-style-type: none"> - understanding the opinions of others - open-minded regarding divergent world views - honesty in facing one's own biases, prejudices, stereotypes, egocentric or sociocentric tendencies
3. Analyticity	<ul style="list-style-type: none"> - being alert to potentially problematic situations - anticipating possible results or consequences - valuing the application of reason and the use of evidence in facing problems which may be challenging or difficult 	<ul style="list-style-type: none"> - alertness to opportunities to use critical thinking - trust in the process of reasoned inquiry - clarity in stating the question or concern - persistence though difficulties are encountered
4. Systematicity	<ul style="list-style-type: none"> - being organized, orderly, focused and diligent in inquiry 	<ul style="list-style-type: none"> - using orderliness in working with complexity - diligence in seeking relevant information - care in focusing attention on the concern at hand
5. Self-confidence	<ul style="list-style-type: none"> - trust in one's own reasoning processes - capable of making good judgements - sought out as a problem solver 	<ul style="list-style-type: none"> - self-confidence in one's own ability to reason
6. Inquisitiveness	<ul style="list-style-type: none"> - intellectual curiosity - values knowing - persists even if no payoff is immediate or directly evident 	<ul style="list-style-type: none"> - inquisitiveness with regard to a wide range of issues - concern to become and remain generally well informed
7. Maturity	<ul style="list-style-type: none"> - making reflective judgements - approaches problems with understanding that judgements will be made based on context and evidence which precludes certainty 	<ul style="list-style-type: none"> - fair-mindedness in appraising reason - prudence in suspending, making or altering judgements - precision to the degree permitted by the subject and circumstances

and with confidence in their judgments (Fiske & Taylor, 1984). This view appears limited as a number of other experiments indicated that people can, under certain conditions, be motivated to process information in more complex, self-critical, and effort-demanding ways (Borgida & Howard-Pitney, 1983; Harkness, DeBono & Borgida, 1985; McAllister, Mitchell & Beach, 1979; Rozelle & Baxter, 1981; Showers & Cantor, 1985; Tetlock, 1983a, 1983b, 1985a; Zajonc, 1960). Of interest in this study is the research on the impact of holding subjects accountable for their judgments and decisions since evidence exists that social demands for accountability can markedly affect the cognitive strategies people use in making judgments and decisions. In Janis and Mann's (1977) terminology, people who expect to justify their views to others will be: (a) more vigilant information processors and (b) more likely to perform difficult cognitive tasks such as the consideration of a variety of options and evidence, tolerance for inconsistency, and receptiveness to new evidence. These tasks are widely regarded as signs of high quality decision making. These attitudes are strikingly related to the critical thinking dispositions cited previously.

Research has demonstrated that accountable decision makers are more likely than unaccountable ones to use cognitively complex rules in choosing among response options (McAllister et al., 1979; Tetlock, 1983a), to be more aware of the determinants of their judgments (Cvetkovich, 1978; Hagafors & Brehmer, 1983), display greater consistency and stability of judgment (Hagafors & Brehmer, 1983), to process persuasive messages in detail rather than rely on their general evaluation of the message source (Chaiken, 1980), and be more discriminating and responsive to evidence in evaluating others (Rozelle & Baxter 1981;

Tetlock, 1983b, 1985b).

Other research, however, suggests that accountability (the need to justify one's views to others) does not always lead to greater cognitive work. Several studies suggest that accountability leads people to take positions they believe are acceptable to others (Adelberg & Batson, 1978; Benton, 1972; Klimoski, 1972; Lamm & Kogan, 1970). In summary, experimental evidence indicates that accountability pressures can affect both what people think (i.e., the preferences and beliefs they express) and how people think (i.e., the reasoning strategies that underlie those preferences and beliefs). Tetlock (1985a) proposed a social contingency model of judgment and choice that integrates the research on accountability into a comprehensive framework. When subjects know the views of the audience to whom they are accountable, simple low-effort thinking will influence the decision process resulting in the acceptability heuristic (Tetlock, 1985a). Subjects simply adopt the salient, socially acceptable position. When people do not know the views of the audience they are accountable to they can be motivated to complex, self-critical information processing which involves considering arguments and evidence on both sides of an issue in order to prepare themselves for as wide a variety as possible of critical reactions to their views. Tetlock (1983a) refers to this as a process of preemptive self criticism. Finally, when people feel accountable for positions to which they are already committed, (i.e., have some ego involvement), the coping strategies of conformity and self-criticism lose much of their attraction. People do not want to appear weak in their convictions, hence the majority of mental effort is focused on defending the original commitments, defense bolstering (Tetlock, Skitka & Boettger, 1989).

It would appear that differing degrees of accountability for one's view on a topic can affect the complexity of one's thinking. If students engage in preemptive self criticism resulting in more complex thinking, it is conceivable that this effort could have some impact on critical thinking dispositions. The interest of this study was to examine the relationship between complexity of thinking given various levels of accountability and critical thinking dispositions.

Student Intellectual Development: William Perry's Model

To appreciate William Perry's model one must understand what precipitated the original research. After completing a baccalaureate degree at Harvard College, Perry began his career at Williams College teaching English literature. In 1947 he returned to Harvard to direct the Bureau of Study Counsel. In 1953 the staff of the Bureau undertook the task of documenting the four-year experience of undergraduates at Harvard and Radcliffe. The inquiry was fostered by the observation that the university, as well as the world, was becoming more complex, calling for a new relativism of knowledge (Perry, 1970). As Henry Adams wrote, "The movement from unity to multiplicity, between 1200 and 1900, was unbroken in sequence and rapid in acceleration. Prolonged one generation longer, it would require a new social mind" (cited in Perry, 1970, p.8). Students at Harvard and Radcliffe were confronted with a pluralism of values in the growing diversity of peers both socioeconomically and geographically. Perry commented, "The growing person's response to pluralism in thought and values, and indeed his capacity to generate pluralism himself, are

therefore critical to the destiny of a democracy" (Perry, p.6). Perry was interested in understanding how students think while confronting pluralism as well as when generating their own pluralism. To understand how students think Perry rejected the structured intelligence test or the rigid questionnaire and chose instead a qualitative research approach, the interview. Students across the four college years were asked to describe their experience. The summation of the data resulted in a developmental scheme that describes the forms by which students construe the nature and origins of knowledge, of value, and of responsibility in a stage process (Perry, 1970).

Conceptually, the scheme or model is based upon the writings of many including Jean Piaget, Robert W. White, Eric Erickson, Heiny Werner, Kurt Levin, Gordon Alport, Peter Blos, R.J. Havighurst, Rollo May, Lawrence Kohlberg, Neal Sanford, and Roy Heath.

The original sample of college students had a heavy male bias, but Perry concluded that gender differences were not significant in the structurings of experience relevant to the developmental scheme but rather in the content of thinking and manner of reporting. The positions were consistent for both males and females. This observation is confirmed in Baxter-Magolda's (1992) Epistemological Reflection Model which illustrates the different strategies of knowing within a stage. These strategies were related to, but not dependent upon, gender.

In the complete form Perry's model distinguishes nine positions in progressive development where position refers to a fairly stable viewpoint as opposed to unstable transitions between positions. Hefferman (1975) has identified the first five positions as

"ways of knowing." These describe the qualitatively different modes of thinking about the nature of knowledge. The last four positions deal with commitment in career, moral values, and personal relationships with a focus on responsibility. The last four positions are clearer demarcations of a lifestyle of responsibility in a complex society.

Perry provides a summary of the nine positions as:

Position 1: The student sees the world in polar terms of we-right-good vs. other-wrong-bad. Right Answers for everything exist in the Absolute, known to Authority whose role is to mediate (teach) them. Knowledge and goodness are perceived as quantitative accretions of discrete rightnesses to be collected by hard work and obedience (paradigm: a spelling test).

Position 2: The student perceives diversity of opinion and uncertainty, and accounts for them as unwarranted confusion in poorly qualified Authorities or as mere exercises set by Authority "so we can learn to find The Answer for ourselves."

Position 3: The student accepts diversity and uncertainty as legitimate but still temporary in areas where Authority "hasn't found The Answer yet." He supposes Authority grades him in these areas on "good expression" but remains puzzled as to standards.

Position 4: (a) The student perceives legitimate uncertainty (and therefore diversity of opinion) to be extensive and raises it to the status of an unstructured epistemological realm of its own in which "anyone has a right to his own opinion," a realm which he sets over against Authority's realm where right-wrong still prevails; or (b) the student discovers qualitative contextual relativistic reasoning as a special case of "what They want" within Authority's realm.

Position 5: The student perceives all knowledge and values (including authority's) as contextual and relativistic and subordinates dualistic right-wrong functions to the status of a special case, in context.

Position 6: The student apprehends the necessity of orienting himself in a relativistic world through some form of personal Commitment (as distinct from unquestioned or unconsidered commitment to simple belief in certainty).

Position 7: The student makes an initial Commitment in some area.

Position 8: The student experiences the implications of Commitment and explores the subjective and stylistic issues of responsibility.

Position 9: The student experiences the affirmation of identity among multiple responsibilities and realizes Commitment as an ongoing, unfolding activity through which he expresses his life style. (Perry, p. 9-10.)

Unique in Perry's cognitive development scheme in contrast to other developmental theories are the alternatives students may experience in their forward developmental process.

These alternatives include:

Temporizing: The student delays in some Position for a year, exploring its implications or explicitly hesitating to take the next step.

Escape: The student exploits the opportunity for detachment offered by the structures of Positions 4 and 5 and deny responsibility through passive or opportunistic alienation.

Retreat: The student entrenches in the dualistic, absolutistic structures of Positions 2 or 3. (Perry, p. 9-10.)

Applications and Extension of the Perry Model

Since Perry's scheme was published in 1970 it has generated a great deal of discussion across many domains. The kinds of college experiences that promote change in the nine positions have been studied by Baxter-Magolda (1987). Instructional approaches used to foster development have been presented in English literature (Bizzell, 1984; Knefelkamp, 1974; Widick, 1975;), history (Widick & Simpson, 1978), mathematics (Copes, 1974; Stonewater, Stonewater & Perry, 1988), engineering (Culver & Hackos, 1981), science (Allen, 1981), religion (Cooper, 1984), and chemistry (Finster, 1989). Studies in curriculum

design (Kovacs, 1977) and faculty consultation (Parker, 1978) speak to the broader use of the Perry scheme. The scheme has also been used to describe a career developmental process (Knefelkamp & Slepitz, 1976) and adolescent intellectual development (King, 1978), to advise adult learners (Chickering, 1976), and to understand gender issues in development and in counseling women (Alishio & Schilling, 1984; Baxter-Magolda, 1987; Belenky, Clinchy, Goldberger & Tarule, 1986; Knefelkamp, Widick & Stroad, 1976).

The most recent extension of Perry's model has been Baxter-Magolda's Epistemological Reflection Model. The methodology duplicated that of Perry, interviewing students about their college experience over the four years. An additional extension was the fifth year interview after students had graduated from college. The summary of this model is presented in Table 2.

In both the original Perry research and in Baxter-Magolda's research it is evident that students progress through developmental stages. Implicit in the comments of students in both studies are attitudes students hold about thinking. Since the stage models are primarily concerned with how students intellectual development occurs it is not unusual that students' attitudes or dispositions toward thinking were left unfocused. The intent of this study was to examine the relationship between students who believed knowledge was absolute or certain (positions 2 and 3 in Perry's Model or positions 1 and 2 in Baxter-Magolda's Model) and students who believed knowledge was relativistic or constructed (positions 4 and 5 in Perry's Model or positions 3 and 4 in Baxter-Magolda's Model) on critical thinking dispositions. The limit of differentiating the first two positions of Perry and the first position of

Table 2. Epistemological reflection model

Domains	Absolute knowing	Transitional knowing	Independent knowing	Contextual knowing
Role of learner	- Obtains knowledge from instructor	- Understand knowledge	- Thinks for self - Shares views with others - Creates own perspective	- Exchanges and compares perspectives - Thinks through problems - Integrates and applies knowledge
Role of peers	- Share materials - Explain what they have learned to each other	- Provide active exchanges	- Shares views - Serve as a source of knowledge	- Enhance learning via quality contributions
Role of instructor	- Communicates knowledge appropriately - Ensures that students understand knowledge	- Uses methods aimed at understanding - Employs methods that help knowledge	- Promotes independent thinking - Promotes exchange of opinions	- Promotes application of knowledge in context - Promotes evaluative discussion of perspectives - Student and teacher work toward goal and measure progress
Evaluation	- Provides vehicle to show instructor what was learned	- Measures students' understanding of the material	- Rewards independent thinking	- Accurately measures competence - Student and teacher work toward goal and measure progress
Nature of knowledge	- Is certain or absolute	- Is partially certain and partially uncertain	- Is uncertain; everyone has own beliefs	- Is contextual; judge on basis of evidence in context

Note. From Baxter-Magolda, (1992). Knowing and reasoning in college.

Baxter-Magolda as opposed to examining all the positions or stages comes from the data in research.

"In our reports, the most difficult instructional moment for the students - and perhaps therefore for the teacher as well - seems to occur at the transition from the conception of knowledge as a quantitative accretion of discrete rightness to the conception of knowledge as the qualitative assessment of contextual observations and relationships" (Perry, p.210).

Baxter-Magolda offers a supporting comment concerning the tenuousness of this transition in knowledge belief. "Until students feel what they think has some validity, it is impossible for them to view themselves as capable of constructing knowledge" (Baxter-Magolda, p. 376).

It would appear that the initial move from absolute to relativistic epistemological belief is a key for student intellectual development which may have a relationship to critical thinking dispositions.

Summary

Critical thinking as a concept and a process has become a buzzword in the last decade. The literature clearly identifies that there are two elements to the concept of critical thinking, a set of reasoning skills and habits of mind or dispositions which impact how one employs the skills. There is a great deal of research on critical thinking skills. What is absent from the literature, however, is a clarity about what fosters or enhances the dispositions.

In an attempt to understand factors that influence dispositions it is helpful to examine literature in cognitive social psychology where attitudinal change is a primary focus of research. The social contingency model of judgment and choice frames what Tetlock

(1985a) calls the accountability model. While the research on accountability demonstrates attitudinal change, this has not been examined in conjunction with critical thinking dispositions.

Further, how students view the nature and origin of knowledge has been demonstrated to impact the complexity of their thinking. While the research on student intellectual development has developed a clearer understanding of how students' personal epistemological beliefs develop, it has not examined dispositions or attitudes toward thinking. The attitudes were implicit in student comments but have not been the focus of investigation.

This study was designed to explore factors which foster critical thinking dispositions. The literature suggests that personal epistemological beliefs and expectations of accountability could conceivably foster or enhance critical thinking dispositions.

CHAPTER 3: METHODOLOGY

The purpose of this chapter is to describe the research methods used to address the research questions that constituted this study. This study explored the relationship between personal epistemological belief and integrative complexity of thinking reflected in an essay given three levels of accountability instruction on critical thinking dispositions. The chapter is divided into the following sections: research design, sample, procedure, instrumentation, hypotheses, methods of data analysis, and protection of the rights of human subjects.

Research Design

This was a causal-comparative study which used a 2×3 factorial design (Table 3). The two independent variables were personal epistemological belief and complexity of thought given three levels of accountability instruction. The dependent variable was a critical thinking disposition posttest score, and the covariate was the critical thinking disposition pretest score.

Sample

The target population for this study was undergraduate students attending non-selective private liberal arts colleges with full-time student bodies of 2,000 students or less who were registered for at least twelve semester hours and had previously earned sixty or more academic semester credit hours. This population was selected for several reasons. The literature suggested that a personal epistemological belief that knowledge is constructed is more likely to be found among juniors and seniors in college than among freshman or sophomore students. A non-

Table 3: Initial research design

Perry Position	Accountability instruction levels		
	Accountable	Not accountable	Small group
2 and 3 ^a			
4 and 5 ^b			

Note: The dependent variable in this study was critical thinking dispositions.

^a Belief that knowledge is concrete or certain.

^b Belief that knowledge is constructed or relative.

selective college would have a greater probability of having some junior and senior students whose personal epistemological belief was that knowledge is absolute. A small liberal arts environment provided opportunity for fewer students per classroom which made the accountability instructions more manageable to administer.

The sample for this study was selected from students attending Grand View College, a private liberal arts college in Des Moines, Iowa with a student population of 1,418 students. Grand View College holds accreditation from the North Central Association of Colleges and Secondary Schools and offers degrees in pre-professional programs as well as in the liberal arts. The mission statement of Grand View College indicated the institution admitted and educated students with diverse academic preparation.

The sample consisted of all undergraduates at Grand View College who had earned

sixty or more academic semester hours of credit and were enrolled full-time during the fall semester of 1994 in a required junior/senior interdisciplinary general education course entitled Integrating Seminar. A total of 145 students were enrolled in the course. Seventeen students who completed the course did not sign the research consent form. No explanation was tendered by those students for not participating. Consequently, the sample size was 128. The sample represented a valid cross-section of the Grand View student body as evidenced by gender, age, ethnicity, and major program (See Appendix D). Consistent with Baxter-Magolda (1992), one could expect this heterogeneous sample to contain both concrete knowers as well as constructed knowers.

Procedure

All students registered for Integrating Seminar during the fall semester of 1994 were asked to participate in the study and given a research consent form (Appendix B), prior to completing any instruments. To avoid contamination by suggesting the study was focused on attitudes about thinking, students were informed at the beginning of the study that the exercises were focused on communication in the college classroom. The Learning Environment Preference (LEP), used to determine personal epistemological belief, and the California Critical Thinking Disposition Inventory (CCTDI) pretest were administered to all participants by the principle researcher during the first week of the semester course. Class discussions were conducted twice per week for fifty minutes in groups of fifteen to twenty participants. Participants self-selected a discussion time that would fit their schedule of

classes. Five full-time faculty members (each with no less than ten years of teaching experience) facilitated the class discussions. These faculty members participated in forty hours of training which included reading the designated texts, conducting discussion groups, and evaluating written work. All students in the seminars read the same texts in the same order, completed weekly writing assignments, and participated in discussions on each text read. This study was incorporated into the summative evaluation of students in Integrating Seminar.

Time was allowed for participants to become accustomed to the reading, writing and discussion format, and for scoring of the Learning Environment Preference.

Based upon personal epistemological belief as reflected in the LEP score, participants were divided into two groups. Group one consisted of participants whose personal epistemological belief reflected a view of knowledge as certain and absolute (representing Perry's positions 2 and 3). Group two consisted of participants whose personal epistemological belief reflected a view of knowledge as constructed and relativistic (representing Perry's positions 4 and 5). The intervention of accountability instruction designed to measure complexity of thinking was administered during the eighth week in a fifteen week semester term.

Within each epistemological group, participants were randomly assigned to one of three types of accountability instructions. One set of participants were identified as accountable and given the following instructions:

Read the assigned text for the week. Provide a written summary of the position taken by the author. The summary need not be longer than one page.

Second, reflect on the text and write a summary of your position on the issue in relation to the author's conclusion. The summary of your thinking needs to be about 150-200 words.

Bring your written summary and response to class next session as you will be asked to explain and justify your views to another individual whose position you do not know on this issue. Your responses will be evaluated as part of your course requirements, i.e. the journal for this reading.

Another set of participants were identified as not accountable and given the same set of instructions except for the last paragraph which read:

Bring your written summary and response to class next session. Your responses will be evaluated as part of your course requirements, i.e. the journal for this reading.

A third set of participants were given the following instructions for small group discussion:

Read the assigned text for the week. Provide a written summary of the position taken by the author. The summary need not be longer than one page. Bring your written summary to class as you will be discussing the author's conclusions in small group. After group discussion you will be asked to write a summary defending the position you take on the issue, explaining why you take that position. Your written response needs to be about 150 -200 words. These will be collected at the end of the class period along with your written summary of the author's position. Your responses will be evaluated as part of your course grade, i.e. the journal for this reading.

Participants engaged in the textual reading prepared a written essay and brought it to the next class. The participants who had the accountable instructions presented their points of view and defended them to other students and the instructor in the next class session. The not accountable group turned in their written assignment to the instructor for evaluation the

next class session. The small group participants conducted their own small group discussion in clusters of 5-6 students for thirty minutes and then wrote their individual position of agreement or disagreement before they left the classroom.

Participants' summaries were evaluated for integrative complexity using the seven point Integrative Complexity Code developed by Schroder, Driver & Strenfert (1967)(Appendix C). The summaries were evaluated by two independent raters. Raters had been trained by the principal researcher by reading the background of the Integrative Complexity Code and rating sample essays.

The inter-rater reliability for the two trained raters was .93. This fell within the acceptable range ($r=.89-.95$) found in the literature on accountability cited in Chapter 2. There were thirteen essays which differed by three or more points on a seven-point Likert scale which necessitated training a third rater to score these essays. The score of the "double blind" third rater was used to assess integrative complexity of the thirteen essays. These thirteen essays were among the first essays read by the raters indicating that the training sessions perhaps did not provide the raters enough sample essays to evaluate before they began reading the participants' essays.

To assess changes in critical thinking dispositions over the semester course, a posttest of the CCTDI was given in the twelfth week of the fifteen week semester term. This allowed for an interval of twelve weeks between pretest and posttest of the CCTDI (Table 4).

A pilot study using these instructions, the Learning Environment Preference, the California Critical Thinking Disposition Inventory, and the Integrative Complexity Code were

Table 4: Data collection schedule

Week	Tasks
1	<ul style="list-style-type: none"> - Introduce the study to participants. - Participants read and sign research consent forms. - Administer the Learning Environment Preference (LEP) survey and the California Critical Thinking Disposition Inventory (CCTDI) pretest.
2 - 7	<ul style="list-style-type: none"> - Seminar discussions led by full-time faculty. - Written responses to textual readings.
8	<ul style="list-style-type: none"> - Accountability level instructions provided for the weekly reading. - Essays produced to be read and evaluated by two independent raters using the Integrative Complexity Scale.
14	- Administer the California Critical Thinking Disposition Inventory (CCTDI) posttest.
15	- Debrief participants on the study.

run prior to the gathering of data to determine adjustments that needed to be made in the procedure. The instructions for the accountability groups were too vague initially and needed to have a page or word limit added to convey to students expectations about the amount of writing that needed to be produced. Second, the instructions for the LEP were confusing for part two of the response section and needed to be clarified for students before they began answering the questions in the instrument. There were no problems administering the CCTDI nor in the rating of the essays which were submitted using the Integrative Complexity Code. A pretest/posttest pattern was not administered in the pilot study.

Instrumentation

The critical thinking dispositions were measured by the California Critical Thinking Disposition Inventory (CCTDI, 1992) published by the California Academic Press (See Appendix C). The instrument was a psychological measure of seven critical thinking dispositions. The format consisted of seventy-five statement prompts which express familiar opinions, beliefs, values, expectations, and perceptions. No college level content knowledge was presumed. The statements elicited responses which indicated the extent to which a respondent was favorably disposed toward the seven subscales of truth-seeking, open-mindedness, analyticity, systematicity, self-confidence, inquisitiveness, and maturity. Each subscale contributed a mathematically equal share to the overall score. The response format was a six-point Likert scale ranging from "strongly agree" to "strongly disagree."

The content and construct validity of the CCTDI was based upon the national expert consensus statement of forty-six critical thinking experts presented in Critical Thinking: A Statement of Expert Consensus for Purposes of Educational Assessment and Instruction (1990). The list of dispositions for the ideal critical thinker have been summarized in the seven subscales. The forty-six experts represented theorists, teachers, and critical thinking specialists from multiple disciplines. Face validity has been confirmed by pilot projects in three different comprehensive universities, one in Canada, one in California, and one in the midwestern United States. Two reliability studies have been conducted on the CCTDI. Cronbach's (1951) coefficient alpha for the first test was .90 and the second test a .91 overall. The seven subscales were also tested for internal consistency and the Cronbach alpha ranged

from .71 to .80. The Cronbach (1951) coefficient alpha on the seven subscales for this study on the pretest and posttest was .79 indicating consistency and stability of the subscales over time.

Students' personal epistemological beliefs were evaluated using the "Learning Environment Preferences: A Recognition Measure of the Perry Scheme of Intellectual Development" (1987) published by the Center for the Study of Intellectual Development (See Appendix C). The format consisted of a five-part survey describing different aspects of the learning environment. Participants indicated on a four-point Likert scale the significance or importance of the item for their preferred learning environment.

The content of the Learning Environment Preference (LEP) focuses on four positions of the Perry scheme as the most applicable to higher education populations: Position 2, perception of diversity of opinion; Position 3, accepting diversity and uncertainty in knowledge; Position 4, legitimate uncertainty of knowledge; and Position 5, knowledge as contextual and relativistic. The five specific domains which relate to epistemology and approaches to learning consisted of: (a) view of knowledge and course content, (b) role of the instructor, (c) role of the student/peers in the classroom, (d) the classroom atmosphere, and (e) the role of evaluation.

The content validity of the LEP was established by expert raters trained in the Perry positions. The raters assigned Perry positions to the LEP items. The original set of items was 134 statements, and through the validation process the final set of sixty items represented the content of Perry's scheme for positions two through five.

The construct validity of the LEP was determined by the internal consistency of the Perry position-keyed items and by an item factor analysis. Cronbach's (1951) coefficient alpha, used as a measure of internal consistency, was computed for each set of position-keyed items across all five domains in the LEP. The alpha reliability coefficients for Perry positions two, three, four, and five were .81, .72, .84, and .84 respectively. These alphas suggest a relative clarity of the underlying concepts in Perry positions two, four, and five with less conceptual clarity about position three. A factor analysis conducted by Moore (1989) demonstrated a pattern of significant loading on each of the four factors. Factor two was clearly defined by Perry position two while the fourth factor less clearly reflected Perry position three. The other two factors seem to reflect a hybrid of Perry positions four and five. Concurrent validity for the LEP was established by examining measures of the Perry scheme and the Measure of Intellectual Development (Knefelkamp et. al, 1984). A moderate Pearson correlation of .36 was statistically significant, yet reflected the two instruments were measuring different concepts. Both the Measure of Intellectual Development and the LEP reflected an upward trend for increased complexity of thinking across the four subgroups, college freshman to seniors (Moore, 1989).

Two limitations Moore (1989) cited for the LEP were its lack of clarity in identifying position three in the Perry scheme and the homogenous population used to test the LEP. Neither of these concerns were a threat to this study because the sample for this study approximated the original sample for the LEP and the use of the LEP in this study was to differentiate two major epistemological divisions reflected in combining Perry's positions two

and three versus four and five.

The instrument used to evaluate participants' complexity of thinking in the written response to accountability instructions was the Integrative Complexity Coding system developed at the Personality-Social Laboratory at Princeton University. This coding system was developed for scoring responses to a semiprojective test designed to assess individual differences in cognitive style (Schroder, Driver & Streufert, 1967). Additional research demonstrated the coding system to be sensitive to situational determinants of integrative complexity (e.g., role demands and group think) as well as individual differences in cognitive style (Tetlock, 1979, 1981, 1983a, 1983b). The integrative complexity coding system has demonstrated reliability and construct validity. It has been successfully applied in a number of research contexts to test hypotheses concerning both personality and situational determinants of complexity or information processing (see Schroder et al. 1967; Streufert & Streufert, 1978; Suedfeld, 1983; Suedfeld & Tetlock, 1977; Tetlock, 1983a, 1985a, 1985b, 1986a; Tetlock & Kim, 1987; Tetlock, Skitka & Boettger, 1989; Tetlock & Boettger, 1989).

The concept of integrative complexity is defined in terms of two cognitive structural properties: differentiation and integration. Differentiation refers to the number of evaluatively distinct dimensions of a problem an individual takes into account. For example, a subject might take an undifferentiated view of homelessness by focusing only on the number of women who are homeless and conclude the problem can be resolved by skill training for women. A more differentiated approach would recognize at least two different perspectives on the issue (e.g., the lack of affordable housing in urban communities and the policy of a

welfare system which only pays for shelter if the woman enters a shelter alone or with her children).

Integration refers to the development of complex connections among differentiated characteristics. Differentiation is therefore a necessary condition for integration. The complexity of integration depends on whether the individual perceives the differentiated characteristics in isolation (low integration), in simple interactions (moderate integration), or in multiple contingent patterns (high integration).

Integrative complexity scores range from one to seven (1 = low differentiation and integration; 3 = moderate/high differentiation, low integration; 5 = moderate/high differentiation, moderate integration; 7 = high differentiation and high integration). Scores of two, four, and six represent transitional levels when there is implicit differentiation or integration. The integration complexity coding system has been used in scoring essays (Claunch, 1964; Schroder et. al, 1965). Essay questions which produce the most construct-relevant responses have the following characteristics: (a) They present the subject with uncertainty or conflict, (b) they express a point of view and ask the subject to consider their agreement or disagreement with it, (c) they present two discrepant points of view, and (d) they present the subject with a number of ideas about which they are asked to consider interrelationships (Schroder, Driver & Streufert, 1967). The Integrative Complexity Coding system, therefore, is an appropriate measure for this study given the nature of the controversial issues presented in the readings. The scale points used for assessing the conceptual level involved in the essays are included in Appendix C.

Hypotheses and Data Analysis

The intent of this study was to explore the relationship between personal epistemological belief and complexity of thinking given three levels of accountability on critical thinking dispositions. The research questions lend themselves to the following hypotheses.

Hypothesis 1: After controlling for pretest differences upper division undergraduate students who hold the personal epistemological belief that knowledge is absolute or certain will demonstrate a difference in critical thinking dispositions from upper division undergraduate students who hold the personal epistemological belief that knowledge is relativistic or constructed.

Hypothesis 2: After controlling for pretest differences upper division undergraduate students who are informed they will be accountable to another individual whose views they do not know on a reading in an Interdisciplinary Seminar will demonstrate a difference in critical thinking dispositions from students who are not held accountable for their views on the reading in the Interdisciplinary Seminar.

Hypothesis 3: After controlling for pretest differences upper division undergraduate students who are informed they will be accountable to another individual whose views they do not know on a reading in an Interdisciplinary Seminar after small group discussion will demonstrate a difference in critical thinking dispositions from students who are not held accountable for their views on the reading in the Interdisciplinary Seminar.

Hypothesis 4: After controlling for pretest differences upper division undergraduates who are informed they will be accountable to another individual whose views they do not know on a reading in an Interdisciplinary Seminar will demonstrate a difference in critical thinking dispositions from students who are informed they will be accountable to another individual whose views they do not know on a reading after small group discussion.

Hypothesis 5: Upper division undergraduates who are accountable for their point of view will demonstrate a difference in written integrative complexity from students who are not accountable for their point of view or are in small group discussion.

Hypothesis 6: After controlling for pretest differences there is an interaction effect between students' personal epistemological beliefs and complexity of thinking given three levels of accountability on critical thinking dispositions.

Data Analysis

Descriptive statistics were calculated on all variables for the total sample to obtain demographic data and to study the distribution of the variables. The six hypotheses in this 2×3 covariance design were intended to be analyzed by the statistical technique of analysis of covariance. The objective of this technique was to determine whether sample variances differed significantly from each other while controlling for differences that may have existed between groups on the California Critical Thinking Disposition Inventory pretest. Since this study was exploratory in nature, the level of significance for all procedures was set at .05.

Protection of Rights of Human Subjects

Students in the Integrating Seminar were asked to voluntarily participate in this study and signed a consent form (see Appendix B) that indicated their agreement to participate in a study on communication in the college classroom. The students were informed their responses would be analyzed only by group and that the writing assignment met the class requirement for a journal entry. Once the data had been gathered the students were debriefed in the 15th week of the semester concerning the hypothesis of the study and assured they could obtain the results of the study from the office of Institutional Research at Grand View College. Consent forms to conduct research at Grand View College and approval by the

Iowa State University Human Subjects Review Committee are in Appendix B.

CHAPTER 4: FINDINGS

Introduction

The purpose of this chapter is to present the findings of this research study. First, the demographic data of the sample is presented followed by a discussion of the data and findings for each research question. The data analysis was designed to be done using an analysis of covariance. The dependent variable, the California Critical Thinking Disposition Inventory (CCTDI) score which reflects attitudes toward critical thinking, was designed to be measured in a pretest/posttest design. The pretest and posttest scores on the CCTDI, however, were significantly correlated. The sample consisted of 128 participants with a mean pretest CCTDI of 301.02, $SD = 29.64$ and a posttest mean of 301.63, $SD = 29.64$. A Pearson Product Moment Correlation for the pre- and post- CCTDI test was $r = .8197, p < .001$. The pretest and posttest scores on the CCTDI were also highly correlated with the Learning Environment Preference (LEP) which measures the Perry Positions, $r = .82$. This violated the assumption that the covariate is unaffected by any of the independent variables, hence the analysis of covariance was inappropriate for analyzing the data..

A hierarchical regression of the posttest on the pretest was conducted to identify factors which might have accounted for the variance in the posttest given that 67% of the variance is accounted for by the CCTDI pretest. Table 5 examines the residual for the probable contributors to the posttest variance.

There was no significant explanation of what specifically contributed to the posttest

variance when the pretest was removed and Perry position, accountability level, and the interaction between the two were entered by steps in the hierarchical regression. Hence, for the analysis of data the CCTDI posttest mean and standard deviation were used as the single measure for critical thinking dispositions. Shifting from an analysis of covariance to an analysis of variance model required the research questions and hypotheses be rewritten. Each research question, the related hypothesis, and the rewritten questions and hypotheses, are described in the section identified as inferential findings.

Table 5. Summary of hierarchical regression analysis for variables predicting posttest CCTDI scores ($N = 128$)

Variable	<i>B</i>	<i>SE B</i>	β
Step 1			
CCTDI pretest	0.8204	0.0511	.8197
Step 2			
Perry position	1.4160	3.0169	.0418
Step 3			
Accountability group	1.1218	1.8503	.0541
Step 4			
Accountability group \times Perry position	3.8741	3.7097	.0939

Note: $R^2 = .67188$ for Step 1; $\Delta R^2 = -.00618$ for Step 2; $\Delta R^2 = -.01125$ for Step 3; $\Delta R^2 = -.01052$ for Step 4.
 $p < .05$.

Descriptive Findings

The 128 participants in this study had a mean age of 24.71 years and a median age of 22.00 years. The gender distribution was 64.1% female and 35.9% male. Over 48% of the sample were from the academic majors of Nursing (22.7%), Business Administration (15.6%), and Human Services (10.2%). Sixty-eight participants (53.1%) were juniors and 60 participants (46.9%) were seniors. Tables of the demographic data can be found in Appendix D.

The Grade Point Average (GPA) of the sample identified in Table 6 range from 1.97 to 4.00 on a 4.00 scale. The mean and median were 3.11 and 3.17 respectively with $SD = 0.49$.

Table 6. Frequency and percent for grade point average

GPA	Frequency	Percent
1.50-1.99	2	1.6
2.00-2.49	8	6.4
2.50-2.99	38	29.6
3.00-3.49	42	32.8
3.50-4.00	38	29.6
	128	100.0

The research questions for this study were focused on two independent variables. The first variable was intellectual development among college undergraduates who had earned sixty or more academic semester credits as measured by the Learning Environment Preference (LEP). The LEP is founded on William Perry's model of intellectual development.

The second independent variable was measuring integrative complexity of thought reflected in an essay evaluated by the Integrative Complexity Scale, a 7-point Likert-type scale. The essays were a response to three different sets of instructions informing the participants what levels of accountability were expected: (a) accountable for defending one's point of view, (b) not accountable, or (c) accountable after small group discussion. The dependent variable for this study was attitudes toward thinking, identified as critical thinking dispositions, and measured by the California Critical Thinking Disposition Inventory (CCTDI). The participants were proportionally distributed in each of the six cells as can be observed in Table 7.

Table 7. Summary of frequency for independent variables

Perry Position	Accountability Instruction Levels			Total <i>N</i>
	Accountable	Not Accountable	Small Group	
2 and 3	25	22	21	68
4 and 5	23	20	17	60
Total <i>N</i>	48	42	38	128

Inferential Findings

Each research question in this study and the hypotheses to which they refer will be summarized in this section.

Research Questions and Hypotheses

Question 1: Is there a difference in critical thinking dispositions between students who hold the personal epistemological belief that knowledge is absolute or certain and the students who hold the personal epistemological belief that knowledge is relativistic or constructed?

Hypothesis 1: After controlling for pretest differences upper division undergraduate students who hold the personal epistemological belief that knowledge is absolute or certain will demonstrate a difference in critical thinking dispositions from upper division undergraduate students who hold the personal epistemological belief that knowledge is relativistic or constructed.

Since the assumptions for analysis of covariance were violated by a strong Person Product Moment Correlation ($r = .8197, p < .001$) between the independent variable LEP and the dependent variable CCTDI, the analysis of covariance was an inappropriate test. This necessitated a revision of Hypothesis 1.

Revised Hypothesis 1: Upper division undergraduate students who hold the personal epistemological belief that knowledge is absolute or certain will demonstrate a difference in critical thinking dispositions from upper division undergraduate students who hold the personal epistemological belief that knowledge is relativistic or constructed.

A t test for independent means indicated that the mean CCTDI score of participants who believe knowledge is relativistic or constructed ($M = 309.40, SD = 26.787$) was significantly higher than participants who believe knowledge is absolute or certain ($M = 294.78, SD = 30.531$) as shown in Table 8.

Table 8. Summary of *t* test on CCTDI for Perry positions

Perry position	<i>n</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i> -value
2 and 3	68	294.78	30.531		
4 and 5	60	309.40	26.787	-2.86	.005**

** $p < .01$.

Question 2: Is there a difference in critical thinking dispositions for students: (a) who are informed they will be accountable to another individual whose views they do not know on a reading, (b) who are informed they will not have to publicly justify their views on a reading, and (c) who are informed they will be involved in a small group discussion prior to being accountable to another individual whose views they do not know on a reading.

This research question is addressed by hypotheses 2, 3, and 4 each of which was designed to compare pretest and posttest means on the CCTDI. Since the analysis of covariance assumptions of parallelism were violated, these hypotheses were not tested as stated.

Therefore, hypotheses 2, 3, and 4 were combined.

Revised Hypothesis 2: Upper division undergraduate students who are informed they will be accountable to another individual whose views they do not know on a textual reading will demonstrate a difference in critical thinking dispositions from students who are not held accountable for their views on the textual reading or from students who are informed they will be accountable after small group discussion of the textual reading.

An analysis of variance indicated no significant difference between the CCTDI variances for any of the three groupings, accountable, not accountable, or small group, $F(2,125) = .803$, N.S. Group assignment as a factor was not significantly related to critical thinking dispositions as can be seen in Table 9.

Table 9. Summary of mean and standard deviation for accountability levels on CCTDI

Accountability level	<i>N</i>	<i>M</i>	<i>SD</i>
Accountable	48	306.13	27.98
Not accountable	42	299.95	28.25
Small Group	38	297.82	33.06

Question 3: Is there a difference in the integrative complexity of thinking reflected in writing between students who are told they are accountable for their point of view compared to students who are not held accountable for their point of view or who participate in a small group discussion?

Hypothesis 5: Upper division undergraduates who are accountable for their point of view will demonstrate a difference in written integrative complexity from students who are not accountable for their point of view or students in small group discussion.

To test this hypothesis the Perry Position and Accountability group were treated as dependent variables. The analysis of variance as indicated in Table 10 showed no significant difference in integrative complexity scores for students who were held accountable for their point of view, students who were not held accountable, or were in a small group discussion, regardless of their Perry position.

Taken as a whole neither Perry position nor accountability grouping either separately or together had any significant impact on integrative complexity score. Table 11 indicates the cell means for each accountability level providing some insight into which cells represent the highest integrative complexity scores.

Table 10. Summary of ANOVA for integrative complexity by Perry position and accountability

Source	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i> -value
Perry position	4.381	1	4.381	2.035	.156
Accountability group	6.871	2	3.436	1.596	.207
2-way interactions					
Perry position × Accountability group	2.998	2	1.499	0.696	.500

$p < .05$.

Table 11. Summary of cell means for integrative complexity score by Perry position and accountability level.

Perry position	Accountability Level		
	Accountable	Not accountable	Small group
2 and 3			
<i>M</i>	3.20	3.00	2.95
<i>SD</i>	1.61	1.48	1.02
<i>N</i>	25	22	21
4 and 5			
<i>M</i>	3.87	2.95	3.41
<i>SD</i>	1.46	1.39	1.77
<i>N</i>	23	20	17

The accountability instructions seem to have fostered more complex writing compared across Perry position 2 and 3 and across Perry position 4 and 5. The Perry position 4 and 5 participants who were not held accountable for their point of view and the small group participants in Perry Position 2 and 3 wrote the least integratively complex essays. This supports the suggestion by Fiske & Taylor (1984) that students who are not held accountable to others for their point of view demonstrate less integrative complexity in their writing.

Question 4: To what extent do personal epistemological beliefs, (knowledge is certain or absolute or knowledge is relativistic and constructed), levels of accountability and integrative complexity interact in impacting students' critical thinking dispositions?

Hypothesis 6: After controlling for pretest differences, there is an interaction effect between students' epistemological beliefs and complexity of thinking given three levels of accountability on critical thinking dispositions.

Since the assumptions for an analysis of covariance were violated, Hypothesis 6 could not be tested without revision.

Revised Hypothesis 6: There is an interaction effect between students' personal epistemological beliefs and complexity of thinking given three levels of accountability on critical thinking dispositions.

An analysis of variance demonstrated a 2-way interaction of significance for Perry position and integrative complexity score on the CCTDI posttest, $F(5,122) = 2.528, p = .034$, as can be seen in Table 12.

A 3-way analysis of variance was used to examine interaction effects between Perry positions, group assignment, and integrative complexity. A 3-way interaction between the variables neared significance as conveyed in Table 13.

Table 12. Summary of ANOVA for Perry position and integrative complexity on CCTDI posttest

Source	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i> -value	<i>p</i> -value
Perry position	5441.111	1	5441.111	7.712	.007**
IC score	5479.854	5	1095.971	1.553	.181
2 - way interactions					
Perry position × IC score	8919.476	5	1783.895	2.528	.034*
Error	67026.408	95	705.541		

* $p < .05$. ** $p < .001$.

Table 13. Summary of ANOVA for Perry position, group assignment, and integrative complexity by CCTDI

Source	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i> -value	<i>p</i> -value
Perry position	5441.111	1	5441.111	7.712	.007**
Accountability group	1133.584	2	566.792	0.803	.451
IC score	5479.854	5	1095.971	1.553	.181
2-way interactions					
Perry × Accountability	391.235	2	195.617	0.277	.758
Perry × IC	8919.476	5	1783.895	2.528	.034*
Accountability × IC	10482.137	10	1048.214	1.486	.157
3-way interactions					
Perry × Accountability × IC	10193.161	7	1456.166	2.064	.055
Error	67026.408	95	705.541		

* $p < .05$. ** $p < .01$.

The Integrative Complexity scale was recoded to combine small cell sizes such that IC score one and two were identified as low complexity, scores of three and four as moderate complexity, and scores of five, six, and seven as high complexity. An examination of the effects of the recoded scores resulted in a significant interaction between Perry position, accountability group assignment and integrative complexity on the CCTDI. Table 14 illustrates these results.

Table 14. Summary of ANOVA for Perry position, accountability group assignment, and integrative complexity combined scores by CCTDI

Source	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i> -value	<i>p</i> -value
Perry position	5879.058	1	5879.058	7.516	.007**
Accountability group	1208.422	2	604.211	0.772	.464
IC score	2544.923	2	1272.462	1.627	.201
2-way interactions					
Perry × Accountability	1791.487	2	895.744	1.145	.322
Perry × IC	3277.080	2	1638.540	2.095	.128
Accountability × IC	1612.536	4	403.134	0.515	.725
3-way interactions					
Perry × Accountability × IC	8119.285	4	2029.821	2.595	.040*
Error	86044.068	110	782.219		

* $p < .05$. ** $p < .01$.

Additional Analysis

In an attempt to ascertain why the hypotheses may not have been supported additional analyses were done using the demographic data. Table 15 shows the correlation coefficients for all variables.

Grade Point Average (GPA) as reported by participants was related to Perry position and to critical thinking dispositions. Collapsing grade point average into three groups (1.00 through 1.99, 2.00 through 2.99, and 3.00 through 4.00) GPA yielded a significant F -value, $F(2,125) = 3.391, p = .037$. A t test comparing means for Perry position 2 and 3 with 4 and 5 by GPA reflected a significant difference as can be seen in Table 16. In addition, an analysis of variance of the CCTDI posttest of the three condensed GPA categories yielded the following results, $F(2,125) = 4.513, p = .013$.

A final item of interest was the effects of Perry position and accountability level on the difference scores (posttest minus pretest) of the seven subscales on the CCTDI. The differences are summarized in Appendix E. There are three subscales, truth-seeking, open-mindedness, and confidence, in which the variance within Perry Positions exceeds the critical value for F in the CCTDI pretests and posttests. Epistemological belief appears related to these three critical thinking dispositions. Participants who hold the Perry epistemological belief that knowledge is constructed or relativistic have higher mean scores on truth-seeking, open-mindedness, and confidence than those who hold the Perry epistemological belief that knowledge is absolute or concrete. The most significant relationship in this study is between the students' personal epistemological belief and the critical thinking disposition score. For

purposes of classroom instruction and for students' intellectual development this has practical significance which warrants further study.

Table 15. Inter correlations and significance levels for all study variables

	Continuous variables					Dichotomous Variables		
	CCTDI pretest	CCTDI posttest	Age	GPA	IC score	Perry position	Accountability group	Gender
Continuous	Pearson product moment correlation coefficients					Point-biserial coefficients		
CCTDI pretest	1.00	.82 (.000***)	.19 (.028*)	.23 (.008**)	.12 (.178)	.27 (.002**)	-.18 (.042*)	.14 (.122)
CCTDI posttest		1.00	.23 (.010**)	.26 (.003**)	.21 (.018*)	.25 (.005**)	-.12 (.189)	.12 (.168)
Age			1.00	.10 (.252)	.21 (.019*)	.08 (.345)	-.08 (.378)	-.01 (.927)
GPA				1.00	.08 (.375)	.22 (.011*)	.06 (.522)	.13 (.155)
IC score					1.00	.13 (.153)	-.11 (.223)	.05 (.553)
Dichotomous						Phi correlation coefficients		
Perry position						1.00	-.03 (.778)	.15 (.094)
Accountability group							1.00	-.13 (.139)
Gender								1.00

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 16. *t* tests of GPA means by Perry position

Perry position	<i>M</i>	<i>t</i>	<i>p</i> -value
2 and 3	2.98	-3.58	.000***
4 and 5	3.27		

*** $p < .001$

CHAPTER 5: CONCLUSION

Introduction

This chapter summarizes the intent of this study, and discusses the findings of the study and its implications for undergraduate educational experience. The final section offers recommendations for further research and draws some conclusions about personal epistemology and critical thinking dispositions.

Summary of the Study

This study was conducted at Grand View College, Des Moines, Iowa in 1994. The total enrollment for Grand View College during the time of this study was 1,418 students. The sample consisted of all students enrolled in the integrating seminar general education course Fall, 1994. A total of 145 students were enrolled in the course with 128 students participating in the study.

The purpose of this study was three-fold. The first purpose was to explore the relationship between personal epistemology (specifically whether one believes knowledge is certain and absolute or whether one believes knowledge is constructed or relativistic) and critical thinking dispositions as defined by the Delphi Project (1990).

Second, the study examined the relationship between undergraduates' complexity of thinking demonstrated in written responses, given three different sets of accountability instructions and critical thinking dispositions as defined by the Delphi Project (1990).

Third, the study examined the interaction between personal epistemological belief and complexity of thinking on critical thinking dispositions.

The study used the California Critical Thinking Disposition Inventory to measure critical thinking dispositions. Personal epistemological beliefs were measured by the Learning Environment Preference developed by Moore (1987) and based upon William Perry's stage theory of intellectual development. Complexity of thinking was measured by the Integrative Complexity Code developed by Schroder, Driver and Streufert (1964).

The review of literature indicated there was a lack of information about factors which influence critical thinking dispositions. The relationship between personal epistemological belief and critical thinking dispositions was not examined previously in the literature, nor was the relationship between accountability and critical thinking dispositions.

This study was based upon four conjectures. First, students who believe knowledge is constructed or relativistic would have stronger dispositions toward critical thinking than would students who believe knowledge is concrete or absolute. Second, students who are held accountable for their point of view on a social issue would think more complexly, demonstrated by writing a more integrative essay, than students who were told they would not be accountable for their point of view, or students who were assigned to a small group discussion. Third, students who write more integratively complex essays would have stronger critical thinking dispositions than those who write less integratively complex essays. Finally, students' critical thinking dispositions may be altered by personal epistemological belief, being held accountable for their thinking, or by some interaction between those

variables.

Discussion of the Findings

Four research hypotheses addressed the four conjectures of this study. This section discusses the findings related to each hypothesis.

Hypothesis 1

The hypothesis that upper division undergraduate students who hold the personal epistemological belief that knowledge is constructed or relativistic will have different critical thinking dispositions than upper division undergraduate students who hold the personal epistemological belief that knowledge is concrete or absolute was supported by the findings. Students who are in the Perry position 4 or 5 are more favorably disposed to think critically than students who are in Perry position 2 or 3. Students who believe knowledge is constructed have a significantly different attitude about critical thinking. To ascertain which attitudes may have been different, a follow up on the seven subscales of the CCTDI was conducted, indicating the Perry position 4 and 5 students were more open-minded, truth-seeking and self-confident than Perry position 2 and 3 students. The conclusion that could be drawn from this was that students who recognize that knowledge was constructed understand that truth was not a matter of simple construction but a complex phenomenon which, per the definition of truthseeking in the CCTDI, reflect attitudes of courageousness about asking questions, honest and objective inquiry and persistence in seeking the truth. Open-

mindedness and self-confidence are closely linked to truth-seeking and reflect a trust in the inquiry process and a willingness to consider multiple points of view in searching for truth. The implication here was that students who believe knowledge is concrete have faith in the authority who presents the knowledge that this is truth. The constructed, relativistic knower understands knowledge to be complex, has confidence in his/her own reasoning capacity and can venture into considering multiple questions about an idea, even seeing different combinations of ideas to produce new knowledge.

Hypothesis 2 (revised to combine hypotheses 2,3 and 4)

The hypothesis that upper division undergraduates who were informed they would be accountable to another individual whose views they did not know on a textual reading would differ from students who were not held accountable for their point of view or were in small group discussion on critical thinking dispositions was not supported in the findings. The accountability instructions by themselves had no significant effect on critical thinking dispositions. Perhaps this was a result of the random assignment of students to accountability groups after being separated into Perry position 2 and 3 and Perry position 4 and 5 groups. The variance within and between groups can be explained by chance rather than because of the impact of instructions. Another possible explanation was that critical thinking dispositions are entrenched by the junior year in college and twelve weeks was insufficient time to see any significant change in attitudes regardless of the expectation of accountability for one's point of view.

Hypothesis 5

Upper division undergraduates who are accountable for their point of view will demonstrate a difference in integrative complexity in their essays from students who are not accountable for their point of view or are in small group discussion was not supported in the findings. Taken as a whole, none of the accountability instructions had significant impact on the complexity of the students' essays. An examination of the mean scores for each of the cells of accountability instruction does indicate the Perry position 4 and 5 students who were accountable wrote the most complex essays which would be consistent with the personal epistemological belief that knowledge is relativistic and hence consists of multiple points of view which can be adjudicated by reason. The Perry position 4 and 5 students who were not held accountable for their point of view and the Perry position 2 and 3 students assigned to small group discussion wrote the least complex essays. This supported Fiske & Taylor's (1984) findings that students not held accountable would write less integratively complex essays than those held accountable. In addition, the Perry position 2 and 3 students still adhere to the belief that knowledge is absolute and concrete, known by authority and presented for the student to consume or learn. Hence, the small group discussion of peers exchanging ideas for the Perry position 2 and 3 students may have been seen as a sharing of opinions, and a muddling around in ideas, which would not produce the "right answer" since truth comes from an authority. Small group discussion, for these students, could be perceived as a poor use of time and frustrating because an authority has the "right answer"

and simple transmission of the idea would be the most efficient use of time.

Hypothesis 6

There was an interaction effect between students' personal epistemological beliefs and complexity of thinking given three levels of accountability on critical thinking dispositions was supported in the findings. Consistently, when Perry position was considered with the critical thinking dispositions there was significant interaction. When group assignment and integrative complexity were added to the discussion a three-way interaction between Perry Position, Accountability Group and Integrative Complexity was significant. It is likely that the Perry position 4 and 5 students have stronger critical thinking dispositions, and write more complexly than Perry position 2 and 3 students, at least when given the instruction of being held accountable for their point of view. An examination of the mean scores for the Perry position 2 and 3 students who were held accountable for their point of view were rated as slightly more complex than the not accountable or small group discussion Perry position 2 and 3 students. This supported the literature on integrative complexity that students who are held accountable will consider multiple perspectives because they must justify their point of view on an issue.

Correlations

An examination of intercorrelations between the variables of this study including demographic variables, yielded seven combinations which were significant. The CCTDI

pretest and the CCTDI posttest had a Pearson Product Moment Correlation Coefficient of $r = .82, p = .000$. This strong positive relationship may have occurred because the dispositions are stable over time or perhaps because there was only one instrument that measured critical thinking dispositions.

The second significant intercorrelation was a point-biserial correlation coefficient $r = .25, p = .005$ representing the relationship between the CCTDI posttest and Perry position. This demonstrated the strong relationship between personal epistemology and one's attitudes toward thinking. Students who perceive knowledge to be constructed or relativistic tend to have higher dispositions for critical thinking.

The third significant intercorrelation was between the CCTDI posttest and the age of the participants. The Pearson Product Moment Correlation Coefficient was $.23, p = .010$. Maturation as reflected by age was linked to more positive attitudes toward critical thinking. Perhaps life experiences as one matures forces individuals to deal with more complex issues that require systematicity, analyticity, openmindedness, truthseeking, etc.

The fourth significant intercorrelation was the CCTDI posttest and participant reported cumulative grade point average. The Pearson Product Moment Correlation was $r = .26, p = .003$. This relationship would be expected given the assumption that a higher grade point average indicates more complex thinking and was therefore linked to more positive attitudes about critical thinking.

The fifth significant intercorrelation was between Perry Position and participant reported cumulative grade point average. The point-biserial correlation coefficient was

$r = .22, p = .011$. The personal epistemological belief that knowledge was constructed or relativistic was positively related to higher grade point averages. The clear connection between academic performance and one's personal belief about knowledge may be related to a desire to create new knowledge.

The sixth significant intercorrelation was between the CCTDI posttest and the integrative complexity score. The Pearson Product Moment Correlation Coefficient was $r = .21, p = .018$. This relationship indicates that participants who had stronger critical thinking dispositions wrote more sophisticated essays which reflected moderate differentiation and moderate integration of complex ideas. Participants who have more positive attitudes about critical thinking tend to write more complexly. This does not suggest having a more positive attitude about thinking will lead to better writing but, rather that more complex writing follows from the persistent pursuit of truth with openmindedness.

The final intercorrelation of significance was between the participants' age and integrative complexity score. The Pearson Product Moment Correlation Coefficient was $r = .21, p = .019$. The more life experiences one has the more complex the writing may become. This tends to be consistent with more positive attitudes toward critical thinking.

While the significant intercorrelations provide information about variables which were related in this study, they do not provide insight into what types of changes occurred in the critical thinking dispositions. This study originally was designed as a pretest, posttest study. Hence, pretest CCTDI means were collected and can be compared to posttest CCTDI means for Perry position 2 and 3 as well as Perry position 4 and 5. The comparisons of the seven

subscales of the CCTDI pretest and posttest are found in Appendix E. The conclusion that can be drawn from this comparison is that the critical thinking disposition of concrete or absolute knowers made more significant gain than the relativistic or constructed knowers. The explanation for this change might be related to William Perry's observation in his original study that students may experience a suspension of intellectual development for a period of time. Perry terms this phenomenon temporizing or escape. While the Perry position 4 and 5 participants have higher disposition toward open-mindedness, truth seeking and self-confidence, the most significant gains from pretest to posttest scores occur for the Perry position 2 and 3 participants, specifically in the subscales of confidence, inquisitiveness, truth seeking and openmindedness. The Perry position 4 and 5 participants have a lower posttest mean on the openmindedness and inquisitiveness subscales compared to their pretest mean.

A possible explanation for this shift in direction of the mean scores for Perry position 2 and 3 participants was that the interdisciplinary seminar provided a variety of opportunities to hear multiple points of view such that Perry position 2 and 3 participants began to be inquisitive about the possibility that there were other ways of viewing a problem than the absolute framework they used previously. The seminar could also have provided a structured framework for shaping the thinking of the Perry position 2 and 3 participants. The Perry position 2 and 3 participants were more confident, inquisitive, truth-seeking and open-minded by the end of the semester. The Perry position 4 and 5 participants perhaps entered into a temporizing or escape phase as described by Perry (1970). The Perry position 4 and 5 participants began the semester with a higher capacity to understand multiple perspectives

exist on any given social issue. What the participants may have experienced is cognitive dissonance in having to take a stand on a complex issue which in effect means declaring a position and then defending that position.

Elkin and Leippe (1986) suggested the most lasting attitude change occurs when an individual was experiencing cognitive dissonance and then was explicitly asked to make public their position on an issue related to the dissonance. This required greater mental effort and was linked to a more lasting attitudinal change. One assumption of this study was that the seminar style classroom would present participants multiple points of view on complex social issues and hence create cognitive dissonance. The Perry position 2 and 3 participants reflected an increase in significance in the CCTDI score for openmindedness indicating a consideration of multiple points of view. The Perry position 4 and 5 participants had significantly higher CCTDI pretest scores on openmindedness than posttest scores. This suggested cognitive dissonance and a temporizing or escape response might have taken place. This could explain the pre-post decrease in the open-mindedness subscale.

Suggestions for Further Study

Problem solving in this complex world demands complex thinking. Maturation alone will not guarantee more sophisticated, reasoned thought. Cognitive skills by themselves are insufficient to resolve our complex issues as well. This study demonstrated a significant relationship between personal epistemology and attitudes toward critical thinking. Personal epistemology has been shown by Perry (1967) and Baxter-Magolda (1993) to change over

time. The assumption can be made that critical thinking dispositions likewise can change over time. The 15-week length of time in this study would indicate a semester term in an undergraduate experience was not sufficient time to see measurable change in the seven critical thinking dispositions. Further study is necessary to examine the time factor for change in critical thinking dispositions.

This study identified four critical thinking dispositions that were significantly different for participants who hold the personal epistemology that knowledge is absolute or certain versus the belief that knowledge is constructed or relativistic. What was not identified in this study is the nature of the relationship between personal epistemology and critical thinking dispositions. Further study needs to be done to examine factors of influence that would foster intellectual development as well as critical thinking dispositions.

The use of accountability did not demonstrate any significant impact on critical thinking dispositions. Further study would need to be done to examine different pedagogical techniques. Another element which needs further study is whether the students believed the instructions given for accountability. Student believability of the instructions may have a relationship to the complexity of thinking and writing. The seminar style has potential to foster dispositional change in individuals who believe knowledge is absolute or concrete. Whether this is the influence of hearing one's peers or the combination of accountability and peer interaction needs to be examined more closely.

While this study focused on critical thinking dispositions in relation to a classroom environment the findings of this study have practical implications for the out-of-class

experience for college students. This study supports the findings of Terenzini, Springer, Pascarella and Nora (1995), who have estimated the relative and unique effect of three dimensions of the college experience which influence critical thinking skills and attitudes: curricular exposure, formal classroom and instructional experiences, and out-of-class experiences. Students' intellectual development is clearly a complex phenomenon and has been demonstrated to be linked to critical thinking dispositions. The out-of-class experience could benefit from programming which considers personal epistemology and critical thinking dispositions. This merits further study in terms of programming and in staff development.

The majority of the research in critical thinking is focused on critical thinking skills. This study however, focused on critical thinking dispositions and identified a relationship between personal epistemology and critical thinking dispositions which adds to the literature. The discussion of critical thinking is not a mere buzz word for the 1990's in higher education but will continue to generate great research interest. The study leaves for future research a closer examination of what factors specifically alter critical thinking dispositions and/or foster the development of personal epistemology.

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APPENDIX A
CALIFORNIA
CRITICAL THINKING DISPOSITION INVENTORY
SUBSCALES

1. The Truth-seeking subscale targets the disposition of being eager to seek the truth, courageous about asking questions, honest and objective about pursuing inquiry. This subscale focuses and extends the American Philosophical Association's Delphi consensus (1991) characteristics of "willingness to reconsider and revise one's views where honest reflection suggests that a change is warranted," "reasonableness in selecting and applying criteria," and "flexibility in considering alternatives and opinions (pg 3)."
2. The Open-mindedness subscale targets the disposition of being open-minded and tolerant of divergent views with sensitivity to the possibility of one's own bias. This subscale focuses the Delphi characteristics of "understanding the opinions of others," "openmindedness regarding divergent world views," and "honesty in facing one's own biases, prejudices, stereotypes, egocentric or sociocentric tendencies (pg 4)."
3. The Analyticity subscale targets the disposition of being alert to potentially problematic situations, anticipating possible results or consequences, and valuing the application of reason and the use of evidence in facing problems which may be challenging or difficult. This subscale is related to the Delphi characteristics of "alertness to opportunities to use critical thinking," "trust in the processes of reasoned inquiry," "clarity in stating the question or concern," and "persistence though difficulties are encountered, (pg 4)."
4. The Systematicity subscale targets the disposition of being organized, orderly, focused and diligent in inquiry. There is no specific assumption about how the systemic person approaches order. The focus is on the consistent, diligent, systematic behavior regardless whether it is linear or non-linear in strategy. The systematicity subscale is closely related to the Delphi characteristics of using "orderliness in working with complexity," "diligence in seeking relevant information," and "care in focusing attention on the concern at hand (pg 4)."
5. The self-confidence subscale refers to the level of trust one places in one's own reasoning processes. Self-confident persons trust themselves to make good judgments and believe others look to them to resolve problems. The self-confidence subscale focuses the Delphi characteristic of "self-confidence in one's own ability to reason (pg 4)."
6. The Inquisitiveness subscale measures one's intellectual curiosity. The inquisitive person is one who values knowing how things work, wants to learn even if the payoff is not immediate or directly evident. The inquisitiveness subscale targets the Delphi characteristics of "Inquisitiveness with regard to a wide range of issues," "concern to become and remain generally well-informed. (pg 4)."

7. The Maturity subscale targets how disposed a person is to make reflective judgments. The California Critical Thinking Disposition Inventory gives preference to those disposed to approach problems with the sense that not all problems are clearly defined or structured and that many times one must make a judgement based on context and evidence which precludes certainty. The maturity subscale focuses the Delphi characteristics of "fair-mindedness in appraising reason," "prudence in suspending, making or altering judgments," and "precision to the degree permitted by the subject and the circumstances (pg 4)."

APPENDIX B
RESEARCH AGREEMENTS

RESEARCH CONSENT AGREEMENT

Please read the following points, and if you are willing to participate in this study on communication in the college seminar classroom sign below:

1. I have freely volunteered to complete these surveys.
2. I have read the instructions on the cover sheets and I understand the tasks described.
3. I have been given an opportunity to ask questions which have been answered to my satisfaction.
4. I understand that results from this research will be reported only in group form; individual results will be coded by the last four digits of my social security number and only be seen by the principal investigator.
5. I understand that I may request in writing a personal summary of my scores on the surveys.
6. I understand that I may freely withdraw my consent to continue participation in this study at anytime without consequence.
7. I understand the time commitment for each of the the surveys will be about 20 to 25 minutes.
8. My signature below indicates that I have read and agreed to the points above prior to returning my surveys.

Printed Name

Signature

Date

GRAND VIEW COLLEGE

Division of Social Sciences

June 16, 1994

Grand View College, having been fully informed of the scope and intent of this research project, grants permission to Alice K. Peterson to conduct research in the Integrating Seminars 360 and 460 during the 1994 summer and fall semesters. It is agreed that Grand View College will be given a full written summary of the research results.



Dr. Ferol Menzel
Director of Institutional Research
Grand View College
1200 Grandview Avenue
Des Moines, Iowa 50316

Last Name of Principal Investigator Peterson

Checklist for Attachments and Time Schedule

The following are attached (please check):

12. ☒ Letter or written statement to subjects indicating clearly:
- a) purpose of the research
 - b) the use of any identifier codes (names, #'s), how they will be used, and when they will be removed (see Item 17)
 - c) an estimate of time needed for participation in the research and the place
 - d) if applicable, location of the research activity
 - e) how you will ensure confidentiality
 - f) in a longitudinal study, note when and how you will contact subjects later
 - g) participation is voluntary; nonparticipation will not affect evaluations of the subject
13. ☒ Consent form (if applicable)
14. ☒ Letter of approval for research from cooperating organizations or institutions (if applicable)
15. ☒ Data-gathering instruments

16. Anticipated dates for contact with subjects:

First Contact

Last Contact

July 16, 1994

Month / Day / Year

December 15, 1994

Month / Day / Year

17. If applicable: anticipated date that identifiers will be removed from completed survey instruments and/or audio or visual tapes will be erased:

June 30, 1995

Month / Day / Year

18. Signature of Departmental Executive Officer

Date

Department or Administrative Unit

✓ Daniel C. Robinson 7/5/94 Deo

19. Decision of the University Human Subjects Review Committee:

☒

Project Approved

☐

Project Not Approved

☐

No Action Required

Patricia M. Keith

Name of Committee Chairperson

7/14/94

Date

PMK, YL

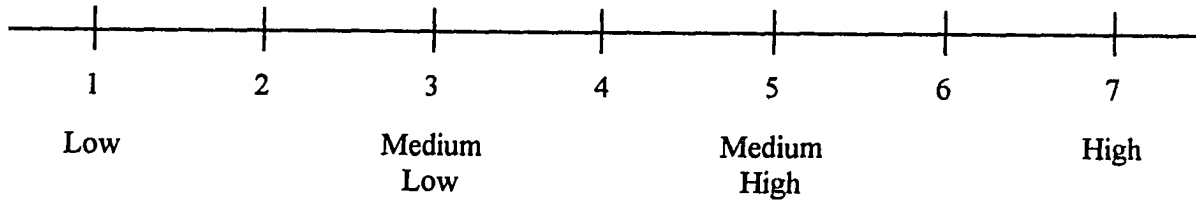
Signature of Committee Chairperson

APPENDIX C
INSTRUMENTS

INTEGRATIVE COMPLEXITY CODING SCALE

General comments for scoring student's written responses to the assigned articles

- Consider the degrees of differentiation.
- Consider the number of degrees of freedom in rules if integration in mediating processes underlying the responses.



Scale Positions

Position 1

- Single fixed approach to the problem
- No alternative interpretations offered in the essay
- High degree of certainty that their position would reduce conflict in the issue
- Avoids gradations of solutions to the issue
- Views the conflict uncertainty or ambiguity of the issue as unpleasant or as a flaw or weakness in people or function
- Seeks fast and unambiguous closure or resolution
- Uses internally consistent processes that reduce incongruity and dissonance
- Offers a specific rule or guide for reducing conflict
- Implies that an absolute solution can be found
- Stating that effects are compartmentalized, are all one way or another way
- Presenting only one side of a problem while ignoring differences and similarities with other views

Position 2

- Transition score between 1 and 3
- Has elements of both 1 and 3
- May suggest a qualification or an absolute but this is not an alternative interpretation of the issue
- Reflects polarity of thinking

Position 3

- Clearly presents the availability of alternative rule structures for perceiving the issue
- Produces in the response alternate and different perceptions of the issue
- May include a conditional rule specifying when each interpretation is used
- Compared to level one, conditionality, probability and alternatives indicate a slight increase in the writing
- May have the following specifics in the writing
- listing of similarities and differences between views without considering relationships between them
 - ▶ provide the specification of at least two different interpretations of the event
 - ▶ the presence of "either-or" type of responses expressing a possible conditional rule about two ways of categorizing the issue
 - ▶ probability statements about the occurrence of different views or outcomes
 - ▶ reactions against absolutism in general
 - ▶ avoidance of dependency on external listed availability of alternatives
 - ▶ response must imply the presence of alternative interpretations regardless of the positivity or negativity of the response

Position 4

- Response implies alternate interpretations
- Implies that alternate interpretations can interact but the interaction is expressed as a qualification of the issue rather than as a comparison where a new alternative is being identified

Position 5

- Integrates two conflicting or different interpretations so as to preserve and not ward off the conflict
- Generates various meanings of alternate perceptions
- Evidence that the writer can take another person's intentions or perspectives into account and to relate different perceptions of different people
- The implication that one's behavior is affected by the way another behaves, as in a give-and -take strategy, i.e., chess game
- A view of social relationships as anchored in mutual responsibility as opposed to fixed rules or beliefs
- Can place oneself in the other person's shoes - empathy
- Can relate to alternate schema in perceiving the issue
- Consideration of alternate reasons for similarities and differences between views

Position 6

- Responses indicate a simultaneous operation of alternatives and give some evidence of the consideration of functional relations between the alternatives

Position 7

- Specific references often are inferred rather than stated at this level
- Conflicting alternatives are viewed as leading to new explanations of the issue or as new ways to organize the information
- Utilization of alternatives through exploratory action in order to obtain new information, if this --- then ---else---
- The generation of functional relations between alternatives
- Consideration of relationships among similarities and differences between the sides of a problem or question
- Development of alternate reasons as to why these differences and similarities exist between alternate positions
- Production of more "connectedness" between alternatives by theorizing as to why these reasons exist



CCTDI

A Disposition Inventory

Dr. Peter A. Facione
Santa Clara University

Dr. Noreen C. Facione
University of California, San Francisco

Wait for the instruction to begin.

C. C. T. D. I.

DIRECTIONS:

1. Carefully separate the last page (ANSWER SHEET) from this test booklet.
2. Put your name on the answer sheet and on the test booklet.
3. Indicate how much you agree or disagree with each numbered statement by filling in the appropriate place on the answer sheet. Read the two examples first.

EXAMPLE A: The best things in life are free.

EXAMPLE B: I'm always doing more than my share of the work.

The answer sheet shows the responses of someone who
STRONGLY DISAGREES with **EXAMPLE A**
and **LESS STRONGLY AGREES** with **EXAMPLE B**.

Begin with statement number 1 and continue through number 75. Mark your response on the answer sheet in the place with the corresponding number. If you erase a response, be sure the erasure is clean.

4. After you have responded to the 75 statements, fill in the information items printed at the bottom of page 5.
-

1. Considering all the alternatives is a luxury I can't afford.
2. Studying new things all my life would be wonderful.
3. The best argument for an idea is how you feel about it at the moment.
4. My trouble is that I'm easily distracted.
5. It's never easy to decide between competing points of view.
6. It bothers me when people rely on weak arguments to defend good ideas.

7. The truth always depends on your point of view.
8. It concerns me that I might have biases of which I'm not aware.
9. I always focus the question before I attempt to answer it.
10. I'm proud that I can think with great precision.
11. We can never really learn the truth about most things.
12. If there are four reasons in favor and one against, I'd go with the four.
13. Men and women are equally logical.
14. Advice is worth exactly what you pay for it.
15. Most college courses are uninteresting and not worth taking.
16. Tests that require thinking, not just memorization, are better for me.
17. I can talk about my problems for hours and hours without solving anything.
18. Others admire my intellectual curiosity and inquisitiveness.
19. Even if the evidence is against me, I'll hold firm to my beliefs.
20. You are not entitled to your opinion if you are obviously mistaken.
21. I pretend to be logical, but I'm not.
22. It's easy for me to organize my thoughts.
23. Everyone always argues from their own self interest, including me.
24. Open-mindedness has limits when it comes to right and wrong.
25. It's important to me to keep careful records of my personal finances.

26. When faced with a big decision, I first seek all the information I can.
27. My peers call on me to make judgments because I decide things fairly.
28. Being open-minded means you don't know what's true and what's not.
29. Banks should make checking accounts a lot easier to understand.
30. It's important to me to understand what other people think about things.
31. I must have grounds for all my beliefs.
32. Reading is something I avoid, if possible.
33. People say I rush into decisions too quickly.
34. Required subjects in college waste time.
35. When I have to deal with something really complex, it's panic time.
36. Foreigners should study our culture instead of us always trying to understand their
37. People think I procrastinate about making decisions.
38. People need reasons if they are going to disagree with another's opinion.
39. Being impartial is impossible when I'm discussing my own opinions.
40. I pride myself on coming up with creative alternatives.
41. Frankly, I am trying to be less judgmental.
42. Frequently I find myself evaluating other people's arguments.
43. I believe what I want to believe.
44. It's just not that important to keep trying to solve difficult problems.

45. I shouldn't be forced to defend my own opinions.
46. Others look to me to establish reasonable standards to apply to decisions.
47. I look forward to learning challenging things.
48. It makes a lot of sense to study what foreigners think.
49. Being inquisitive is one of my strong points.
50. I look for facts that support my views, not facts that disagree.
51. Complex problems are fun to try to figure out.
52. I take pride in my ability to understand the opinions of others.
53. Analogies are about as useful as a sailboat on a freeway.
54. You could describe me as logical.
55. I really enjoy trying to figure out how things work.
56. Others look to me to keep working on a problem when the going gets tough.
57. Getting a clear idea about the problem at hand is the first priority.
58. My opinion about controversial topics depends a lot on who I talk to last.
59. No matter what the topic, I am eager to know more about it.
60. There is no way to know whether one solution is better than another.
61. The best way to solve problems is to ask someone else for the answers.
62. Many questions are just too frightening to ask.
63. I'm known for approaching complex problems in an orderly way.

64. Being open-minded about different world views is less important than people think.
65. Learn everything you can, you never know when it could come in handy.
66. Life has taught me not to be too logical.
67. Things are as they appear to be.
68. If I have to work on a problem, I can put other things out of my mind.
69. Others look to me to decide when the problem is solved.
70. I know what I think, so why should I pretend to ponder my choices.
71. Powerful people determine the right answer.
72. It's impossible to know what standards to apply to most questions.
73. Others are entitled to their opinions, but I don't need to hear them.
74. I'm good at developing orderly plans to address complex problems.
75. To get people to agree with me I would give any reason that worked.

Please respond to these final items in the places provided on this page.

Name (last/first) _____ / _____

I.D. _____

Date of Birth (month/day/year) ____/____/____

Circle one: Female, Male

Circle one: Frosh, Soph, Junior, Senior, BA/BS, MA/MS, Doctorate

Major field of study: _____

Occupation: _____

Answer Sheet -- C. C. T. D. I.

Name: _____ 100 I.D. _____

Eg.A ○ ○ ○ ○ ○ ●
Agree Strongly.....Disagree Strongly
Eg.B ○ ● ○ ○ ○ ○

33. ○ ○ ○ ○ ○ ○
Agree Strongly.....Disagree Strongly

34. ○ ○ ○ ○ ○ ○

67. ☐ ☐ ☐ ☐ ☐ ☐
 Agree Strongly.....Disagree Strongly

68. ☐ ☐ ☐ ☐ ☐ ☐

1. ○ ○ ○ ○ ○ ○
Agree Strongly.....Disagree Strongly

2. ○ ○ ○ ○ ○ ○

3. ○ ○ ○ ○ ○ ○

4. ○ ○ ○ ○ ○ ○
Agree Strongly.....Disagree Strongly

5. ○ ○ ○ ○ ○ ○

6. ○ ○ ○ ○ ○ ○
Agree Strongly.....Disagree Strongly

7. ○ ○ ○ ○ ○ ○

8. ○ ○ ○ ○ ○ ○
Agree Strongly.....Disagree Strongly

9. ○ ○ ○ ○ ○ ○

10. ○ ○ ○ ○ ○ ○
Agree Strongly.....Disagree Strongly

11. ○ ○ ○ ○ ○ ○

12. ○ ○ ○ ○ ○ ○
Agree Strongly.....Disagree Strongly

13. ○ ○ ○ ○ ○ ○

14. ○ ○ ○ ○ ○ ○
Agree Strongly.....Disagree Strongly

15. ○ ○ ○ ○ ○ ○

16. ○ ○ ○ ○ ○ ○
Agree Strongly.....Disagree Strongly

17. ○ ○ ○ ○ ○ ○

18. ○ ○ ○ ○ ○ ○
Agree Strongly.....Disagree Strongly

19. ○ ○ ○ ○ ○ ○

20. ○ ○ ○ ○ ○ ○
Agree Strongly.....Disagree Strongly

21. ○ ○ ○ ○ ○ ○

22. ○ ○ ○ ○ ○ ○
Agree Strongly.....Disagree Strongly

23. ○ ○ ○ ○ ○ ○

24. ○ ○ ○ ○ ○ ○
Agree Strongly.....Disagree Strongly

25. ○ ○ ○ ○ ○ ○

26. ○ ○ ○ ○ ○ ○
Agree Strongly.....Disagree Strongly

27. ○ ○ ○ ○ ○ ○

28. ○ ○ ○ ○ ○ ○
Agree Strongly.....Disagree Strongly

29. ○ ○ ○ ○ ○ ○

30. ○ ○ ○ ○ ○ ○
Agree Strongly.....Disagree Strongly

31. ○ ○ ○ ○ ○ ○

32. ○ ○ ○ ○ ○ ○
Agree Strongly.....Disagree Strongly

35. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0
Agree Strongly.....Disagree Strongly

36. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0

37. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0
Agree Strongly.....Disagree Strongly

38. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0

39. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0
Agree Strongly.....Disagree Strongly

40. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0

41. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0
Agree Strongly.....Disagree Strongly

42. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0

43. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0
Agree Strongly.....Disagree Strongly

44. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0

45. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0
Agree Strongly.....Disagree Strongly

46. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0

47. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0
Agree Strongly.....Disagree Strongly

48. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0

49. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0
Agree Strongly.....Disagree Strongly

50. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0

51. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0
Agree Strongly.....Disagree Strongly

52. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0

53. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0
Agree Strongly.....Disagree Strongly

54. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0

55. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0
Agree Strongly.....Disagree Strongly

56. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0

57. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0
Agree Strongly.....Disagree Strongly

58. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0

59. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0
Agree Strongly.....Disagree Strongly

60. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0

61. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0
Agree Strongly.....Disagree Strongly

62. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0

63. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0
Agree Strongly.....Disagree Strongly

64. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0

65. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0
Agree Strongly.....Disagree Strongly

66. ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0 ☐ 0

69. ○ ○ ○ ○ ○ ○
Agree Strongly.....Disagree Strongly

70. ○ ○ ○ ○ ○ ○

71. ○ ○ ○ ○ ○ ○
Agree Strongly.....Disagree Strongly

72. ○ ○ ○ ○ ○ ○

73. ○ ○ ○ ○ ○ ○
Agree Strongly.....Disagree Strongly

74. ○ ○ ○ ○ ○ ○

75. 0 0 0 0 0 0

[illegible]

For scoring purposes only. Do not write in these boxes.

LEARNING ENVIRONMENT PREFERENCES

© 1987

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Center for the Study of Intellectual Development
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Olympia, WA 98502
206-786-5094

LEARNING ENVIRONMENT PREFERENCES

This survey asks you to describe what you believe to be the most significant issues in your **IDEAL LEARNING ENVIRONMENT**. Your opinions are important to us as we study teaching and learning concerns in college. We ask, therefore, that you take this task seriously and give your responses some thought. We appreciate your cooperation in sharing what you find most important in a learning environment.

The survey consists of five sections, each representing a different aspect of learning environments. In each section, you are presented with a list of specific statements about that particular area. Try not to focus on a specific class or classes as you think about these items; focus on their significance in an *ideal* learning environment *for you*.

We ask that you do two things for each area:

- First, please **rate** each statement in the area in terms of its significance or importance to your learning using the scale below.
- Once you've rated all of the items in a section, go back through the list and **rank** the three items most significant to you as you think about your ideal learning environment.

Please mark your answers on the separate answer sheet provided, and be sure to indicate both your ratings of individual items **and** your ranking of the top 3 items in each section. It is very important that you indicate your top three choices for each question area by writing the ITEM NUMBER in the spaces provided (1st choice, 2nd choice, 3rd choice) at the bottom of the answer sheet.

Rating Scale:

1	2	3	4
Not at all	Somewhat	Moderately	Very
significant	significant	significant	significant

Before you begin, we ask that you provide us with the background information requested at the top of the answer sheet. This information will be used to examine group differences; your name or social security number may be used at some point in the future if a follow-up survey is required. **AT NO TIME WILL THIS INFORMATION BE USED TO REPORT YOUR INDIVIDUAL RESPONSES TO ANYONE BUT YOU; ALL SURVEYS WILL BE KEPT CONFIDENTIAL.** Again, thank you very much for sharing with us your ideas about learning.

LEARNING ENVIRONMENT PREFERENCES--
DOMAIN ONE: COURSE CONTENT/VIEW OF LEARNING

MY IDEAL LEARNING ENVIRONMENT WOULD:

1. Emphasize basic facts and definitions.
2. Focus more on having the right answers than on discussing methods or how to solve problems.
3. Insure that I get all the course knowledge from the professor.
4. Provide me with an opportunity to learn methods and solve problems.
5. Allow me a chance to think and reason, applying facts to support my opinions.
6. Emphasize learning simply for the sake of learning or gaining new expertise.
7. Let me decide for myself whether issues discussed in class are right or wrong, based on my own interpretations and ideas.
8. Stress the practical applications of the material.
9. Focus on the socio-psycho, cultural and historical implications and ramifications of the subject matter.
10. Serve primarily as a catalyst for research and learning on my own, integrating the knowledge gained into my thinking.
11. Stress learning and thinking on my own, not being spoonfed learning by the instructor.
12. Provide me with appropriate learning situations for thinking about and seeking personal truths.
13. Emphasize a good positive relationship among the students and between the students and teacher.

PLEASE BE SURE TO REVIEW THE ABOVE LIST AND MARK YOUR THREE MOST SIGNIFICANT ITEMS (BY ITEM NUMBER) IN THE LINES PROVIDED ON THE ANSWER SHEET.

Rating Scale:

1	2	3	4
Not at all significant	Somewhat significant	Moderately significant	Very significant

ROLE OF INSTRUCTOR

IN MY IDEAL LEARNING ENVIRONMENT, THE TEACHER WOULD:

1. Teach me all the facts and information I am supposed to learn.
2. Use up-to-date textbooks and materials and teach from them, not ignore them.
3. Give clear directions and guidance for all course activities and assignments.
4. Have only a minimal role in the class, turning much of the control of course content and class discussions over to the students.
5. Be not just an instructor, but more an explainer, entertainer and friend.
6. Recognize that learning is mutual--individual class members contribute fully to the teaching and learning in the class.
7. Provide a model for conceptualizing living and learning rather than solving problems.
8. Utilize his/her expertise to provide me with a critique of my work.
9. Demonstrate a way to think about the subject matter and then help me explore the issues and come to my own conclusions.
10. Offer extensive comments and reactions about my performance in class(papers, exams, etc.).
11. Challenge students to present their own ideas, argue with positions taken, and demand evidence for their beliefs.
12. Put a lot of effort into the class, making it interesting and worthwhile.
13. Present arguments on course issues based on his/her expertise to stimulate active debate among class members.

PLEASE BE SURE TO REVIEW THE ABOVE LIST AND MARK YOUR THREE MOST SIGNIFICANT ITEMS (BY ITEM NUMBER) IN THE LINES PROVIDED ON THE ANSWER SHEET.

Rating Scale:

1	2	3	4
Not at all significant	Somewhat significant	Moderately significant	Very significant

ROLE OF STUDENT/PEERS

IN MY IDEAL LEARNING ENVIRONMENT, AS A STUDENT I WOULD:

1. Study and memorize the subject matter--the teacher is there to teach it.
2. Take good notes on what's presented in class and reproduce that information on the tests.
3. Enjoy having my friends in the class, but other than that classmates don't add much to what I would get from a class.
4. Hope to develop my ability to reason and judge based on standards defined by the subject.
5. Prefer to do independent research allowing me to produce my own ideas and arguments.
6. Expect to be challenged to work hard in the class.
7. Prefer that my classmates be concerned with increasing their awareness of themselves to others in relation to the world.
8. Anticipate that my classmates would contribute significantly to the course learning through their own expertise in the content.
9. Want opportunities to think on my own, making connections between the issues discussed in class and other areas I'm studying.
10. Take some leadership, along with my classmates, in deciding how the class will be run.
11. Participate actively with my peers in class discussions and ask as many questions as necessary to fully understand the topic.
12. Expect to take learning seriously and be personally motivated to learn the subject.
13. Want to learn methods and procedures related to the subject--learn how to learn.

PLEASE BE SURE TO REVIEW THE ABOVE LIST AND MARK YOUR THREE MOST SIGNIFICANT ITEMS (BY ITEM NUMBER) IN THE LINES PROVIDED ON THE ANSWER SHEET.

Rating Scale:

1	2	3	4
Not at all significant	Somewhat significant	Moderately significant	Very significant

CLASSROOM ATMOSPHERE/ACTIVITIES

IN MY IDEAL LEARNING ENVIRONMENT, THE CLASSROOM ATMOSPHERE AND ACTIVITIES WOULD:

1. Be organized and well-structured--there should be clear expectations set (like a structured syllabus that's followed).
2. Consist of lectures(with a chance to ask questions) because I can get all the facts I need to know more efficiently that way.
3. Include specific, detailed instructions for all activities and assignments.
4. Focus on step-by-step procedures so that if you did the procedure correctly each time, your answer would be correct.
5. Provide opportunities for me to pull together connections among various subject areas and then construct an adequate argument.
6. Be only loosely structured, with the students themselves taking most of the responsibility for what structure there is.
7. Include research papers, since they demand that I consult sources and then offer my own interpretation and thinking.
8. Have enough variety in content areas and learning experiences to keep me interested.
9. Be practiced and internalized but be balanced by group experimentation, intuition, comprehension, and imagination.
10. Consist of a seminar format, providing an exchange of ideas so that I can critique my own perspectives on the subject matter.
11. Emphasize discussions of personal answers based on relevant evidence rather than just right and wrong answers.
12. Be an intellectual dialogue and debate among a small group of peers motivated to learn for the sake of learning.
13. Include lots of projects and assignments with practical, everyday applications.

PLEASE BE SURE TO REVIEW THE ABOVE LIST AND MARK YOUR THREE MOST SIGNIFICANT ITEMS (BY ITEM NUMBER) IN THE LINES PROVIDED ON THE ANSWER SHEET.

Rating Scale:

1	2	3	4
Not at all significant	Somewhat significant	Moderately significant	Very significant

EVALUATION PROCEDURES

EVALUATION PROCEDURES IN MY IDEAL LEARNING ENVIRONMENT WOULD:

1. Include straightforward, not "tricky," tests, covering only what has been taught and nothing else.
2. Be up to the teacher, since s/he knows the material best.
3. Consist of objective-style tests because they have clearcut right or wrong answers.
4. Be based on how much students have improved in the class and on how hard they have worked in class.
5. Provide an opportunity for me to judge my own work along with the teacher and learn from the critique at the same time.
6. Not include grades, since there aren't really any objective standards teachers can use to evaluate students' thinking.
7. Include grading by a prearranged point system(homework, participation, tests, etc.), since I think it seems the most fair.
8. Represent a synthesis of internal and external opportunities for judgement and learning enhancing the quality of the class.
9. Consist of thoughtful criticism of my work by someone with appropriate expertise.
10. Emphasize essay exams, papers, etc. rather than objective-style tests so that I can show how much I've learned.
11. Allow students to demonstrate that they can think on their own and make connections not made in class.
12. Include judgments of the quality of my oral and written work as a way to enhance my learning in the class.
13. Emphasize independent thinking by each student, but include some focus on the quality of one's arguments and evidence.

PLEASE BE SURE TO REVIEW THE ABOVE LIST AND MARK YOUR THREE MOST SIGNIFICANT ITEMS (BY ITEM NUMBER) IN THE LINES PROVIDED ON THE ANSWER SHEET.

Rating Scale:

1	2	3	4
Not at all significant	Somewhat significant	Moderately significant	Very significant

TEAR OFF THIS PAGE.

YOUR ANSWER SHEET IS ON THE BACK.

LEARNING ENVIRONMENT PREFERENCES ANSWER SHEET

NAME (optional): _____ DATE: _____

SOCIAL SECURITY NO. (or Student ID): _____

SEX (check one): Male _____ Female _____ AGE: _____

ETHNIC HERITAGE (check one): African-Am. _____ Asian-Am. _____ Hispanic _____
Native Am. _____ White _____ Other _____

CLASSIFICATION (check one): Frosh _____ Soph. _____ Jr. _____ Sr _____ Grad _____

MAJOR (If undeclared, please indicate): _____

CURRENT OVERALL GPA: _____

Rating Scale:

1	2	3	4
Not at all significant	Somewhat significant	Moderately significant	Very significant

DOMAIN: COURSE CONTENT/VIEW OF LEARNING (INDICATE RATING, 1-4)

1. _____	2. _____	3. _____	4. _____	5. _____	6. _____	7. _____
8. _____	9. _____	10. _____	11. _____	12. _____	13. _____	

DOMAIN: ROLE OF INSTRUCTOR (INDICATE RATING, 1-4)

1. _____	2. _____	3. _____	4. _____	5. _____	6. _____	7. _____
8. _____	9. _____	10. _____	11. _____	12. _____	13. _____	

DOMAIN: ROLE OF STUDENT/PEERS (INDICATE RATING, 1-4)

1. _____	2. _____	3. _____	4. _____	5. _____	6. _____	7. _____
8. _____	9. _____	10. _____	11. _____	12. _____	13. _____	

DOMAIN: CLASSROOM ATMOSPHERE (INDICATE RATING, 1-4)

1. _____	2. _____	3. _____	4. _____	5. _____	6. _____	7. _____
8. _____	9. _____	10. _____	11. _____	12. _____	13. _____	

DOMAIN: EVALUATION PROCEDURES (INDICATE RATING, 1-4)

1. _____	2. _____	3. _____	4. _____	5. _____	6. _____	7. _____
8. _____	9. _____	10. _____	11. _____	12. _____	13. _____	

INDICATE TOP THREE CHOICES IN EACH AREA (MARK ITEM NUMBER)

<u>COURSE CONTENT</u>	<u>ROLE OF INSTRUCTOR</u>	<u>ROLE OF STUDENT/PEERS</u>	<u>CLASSROOM ATMOSPHERE</u>	<u>EVALUATION PROCEDURES</u>
1ST _____	1ST _____	1ST _____	1ST _____	1ST _____
2ND _____	2ND _____	2ND _____	2ND _____	2ND _____
3RD _____	3RD _____	3RD _____	3RD _____	3RD _____

APPENDIX D
SAMPLE DEMOGRAPHICS

Table 17. Frequency and percent of age distribution ($N = 128$)

Age	Frequency	Percent
19	3	2.3
20	28	21.9
21	21	16.4
22	16	12.5
23	12	9.4
24	9	7.0
25	10	7.8
26	1	0.8
27	2	1.6
29	3	2.3
30	4	3.1
31	2	1.6
32	1	0.8
33	5	3.9
34	1	0.8
38	2	1.6
39	1	0.8
40	1	0.8
41	1	0.8
42	1	0.8
43	1	0.8
48	1	0.8
50	1	0.8
52	1	0.8
Total	128	100

$M = 24.711$, $SD = 6.595$.

Table 18. Frequency and percent of gender distribution ($N = 128$)

Gender	Frequency	Percent
Male	46	35.9
Female	82	64.1

Table 19. Frequency and percent of class status ($N = 128$)

Class	Frequency	Percent
Junior (60-89 hours)	68	53.1
Senior (90+ hours)	60	46.9

Table 20. Frequency and percent of academic majors ($N = 128$)

Academic Major	Frequency	Percent
Accounting	7	5.5
Applied Computer Science	6	4.7
Biology	9	7.0
Business Administration	20	15.6
Commercial Art	5	3.9
Criminal Justice	5	3.9
Elementary Education	6	4.7
English	4	3.1
Social Science	1	.8
Human Behavior	6	4.7
Human Services	13	10.2
Journalism	2	1.6
Liberal Studies	1	.8
Mass Communication	3	2.3
Nursing	29	22.7
Radio/TV	5	3.9
Religion	2	1.6
Secondary Education	4	3.1

APPENDIX E
SUBSCALE ANOVA SUMMARIES

Table 21. Summary ANOVA for subscale truth-seeking of CCTDI pretest and posttest

Source	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i> -value	<i>p</i> -value
Pretest					
Perry position	321.323	1	321.323	7.473	.007**
Accountability group	95.540	2	47.770	1.111	.333
2-way interaction					
Perry × Accountability	17.263	2	8.632	0.201	.818
Posttest					
Perry position	162.292	1	162.292	4.710	.032*
Accountability group	54.344	2	27.172	0.789	.457
2-way interaction					
Perry × Accountability	11.580	2	5.790	0.168	.846

* $p < .05$. ** $p < .01$.

Table 22. Summary ANOVA for subscale open-mindedness of CCTDI pretest and posttest

Source	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i> -value	<i>p</i> -value
Pretest					
Perry position	274.165	1	274.165	8.929	.003*
Accountability group	93.191	2	46.596	1.518	.223
2-way interaction					
Perry × Accountability	60.670	2	30.335	0.988	.375
Posttest					
Perry position	184.352	1	184.352	6.981	.009*
Accountability group	103.656	2	51.828	1.963	.145
2-way interaction					
Perry × Accountability	23.724	2	22.862	0.449	.639

* $p < .05$.

Table 23. Summary ANOVA for subscale analyticity on CCTDI pretest and posttest

Source	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i> -value	<i>p</i> -value
Pretest					
Perry position	67.412	1	67.412	2.032	.157
Accountability group	88.855	2	44.427	1.339	.266
2-way interaction					
Perry × Accountability	108.112	2	54.056	1.630	.200
Posttest					
Perry position	71.940	1	71.940	2.229	.138
Accountability group	4.885	2	2.443	0.076	.927
2-way interaction					
Perry × Accountability	54.245	2	27.122	0.840	.434

 $p < .05$.

Table 24. Summary ANOVA for subscale systematicity on CCTDI pretest and posttest

Source	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i> -value	<i>p</i> -value
Pretest					
Perry position	30.647	1	30.647	0.736	.393
Accountability group	50.361	2	25.180	0.605	.548
2-way interaction					
Perry × Accountability	225.283	2	112.641	2.705	.071
Posttest					
Perry position	17.458	1	17.458	0.397	.530
Accountability group	7.627	2	3.813	0.087	.917
2-way interaction					
Perry × Accountability	110.278	2	55.139	1.255	.289

 $p < .05$.

Table 25. Summary ANOVA for subscale self-confidence on CCTDI pretest and posttest

Source	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i> -value	<i>p</i> -value
Pretest					
Perry position	336.503	1	336.503	8.190	.005*
Accountability group	67.624	2	33.812	0.823	.442
2-way interaction Perry × Accountability	82.911	2	41.456	1.009	.368
Posttest					
Perry position	380.991	1	380.991	8.848	.004*
Accountability group	39.029	2	19.514	0.453	.637
2-way interaction Perry × Accountability	161.621	2	80.810	1.877	.157

* $p < .05$.

Table 26. Summary of ANOVA for subscale inquisitiveness on CCTDI pretest and posttest

Source	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i> -value	<i>p</i> -value
Pretest					
Perry position	321.323	1	321.323	7.473	.007*
Accountability group	95.540	2	47.770	1.111	.333
2-way interaction					
Perry × Accountability	17.263	2	8.632	0.201	.818
Posttest					
Perry position	158.117	1	158.117	3.109	.080
Accountability group	69.182	2	34.591	0.680	.508
2-way interaction					
Perry × Accountability	148.438	2	74.219	1.459	.236

* $p < .05$.

Table 27. Summary ANOVA for subscale maturity on CCTDI pretest and posttest

Source	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i> -value	<i>p</i> -value
Pretest					
Perry position	93.857	1	93.857	1.897	.171
Accountability group	65.505	2	32.753	0.662	.518
2-way interaction					
Perry × Accountability	90.088	2	45.044	0.910	.405
Posttest					
Perry position	122.759	1	122.759	2.962	.088
Accountability group	96.810	2	48.405	1.168	.315
2-way interaction					
Perry × Accountability	53.607	2	26.804	0.647	.526

 $p < .05$.